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THE
MINERAL WATERS OF THE UNITED STATES
AND THEIR
THERAPEUTIC USES.

WITH AN ACCOUNT OF THE VARIOUS MINERAL SPRING
LOCALITIES, THEIR ADVANTAGES AS HEALTH
RESORTS, MEANS OF ACCESS, ETC.

TO WHICH IS ADDED AN APPENDIX ON

POTABLE WATERS.

5794.18

BY

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PREFACE.

Centuries of experience have demonstrated that in certain disorders the intelligent use of mineral waters is a more potent curative agency than drugs. European peoples have not failed to appreciate the immense advantages of their national resources of this character, but Americans have largely overlooked the fact that within their own borders are found the close counterparts of the best foreign springs. It is not too much to say that for charm of scenery and surroundings, salubrity of climate, and facilities for comfort, many American spas will compare favorably with the most highly developed Old World resorts.

A complete and discriminating work on the mineral waters of the United States has been distinctly needed. Though several excellent volumes have been written they have become antiquated through natural causes, such as the abandonment of certain once popular spring resorts and the development of a large number of new and important spas. In the present volume, for instance, more than two hundred mineral spring localities are for the first time described in a book of this kind.

In the construction of the work the author's methods have been as follows: 1. All available literature pertaining to the American mineral springs has been carefully examined. This includes all of the preceding treatises on mineral waters and the various State and National Geological reports, beside numerous maps, railroad guides, etc. 2. Letters of inquiry have been addressed to every spring resort and commercial spring in the United States accessible by the United States post-office. Correspondence has been conducted with mineral spring proprietors, resident physicians, postmasters, army and navy officers, and others. 3. Personal visits have been made from time to time to many important localities in different States.

In the elaborate and well-nigh exhaustive tabulation of the American mineral springs made for the United States Geological Survey by Dr. Albert C. Peale, 2822 mineral spring localities are enumerated. In the course of the present investigation the author has learned that, while some of these springs have fallen into disuse, more than half of them have never been developed, and a very considerable number have not even been examined or named. These classes have been eliminated, while a few have been excluded on the ground of worthlessness or unadaptability to medical purposes. It is the author's belief that in the following pages the practitioner will find by far the most comprehensive account of the mineral springs of our country which has ever been written, and that it includes practically all the principal springs in use at the present day. Every known variety of mineral water is represented, and it is hoped that the enquirer will find the essential facts relating to the uses of such waters in the therapeutic art.

Acknowledgment should here be made to the many writers on mineral springs and cognate subjects, whose works have materially aided in the preparation of the present volume. Special mention should be made of the writings of John Bell and A. N. Bell, Moorman, Walton, Peale, Winslow Anderson, J. A. Irwin, Stiles Kennedy, J. A. Duggan and Simon Baruch on this side of the Atlantic, and to those of Althaus, McPherson, Carl Braun, J. Braun, H. Weber, Liebreich, Helfert, Reiner, Valenteiner, Beaumetz, Winternitz, Bartels, and Jurgensen in Europe. The author's thanks are also due to E. E. Smith, M.D., Ph.D., chemist, of New York, who has corrected a number of the analyses and who contributes the part on Potable Waters.

36 E. Twenty-ninth St., New York, May 15, 1899.

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Page 26, *for* American Carlsbad Springs, *read* Green Lawn Springs.

PART I.

ON MINERAL WATERS AND THEIR THERAPEUTIC USES.

CHAPTER I.

INTRODUCTION.

The term **Mineral Waters** is applied to those waters which are used in the treatment of disease, either by internal administration or by external application, and which owe their virtue to their solid or gaseous constituents or to their elevated temperature. The study of the origin and composition of these waters is embraced in the science of hydrology, which may properly be regarded as a department of geology and of physical geography.

Hydro-therapeutics, or **hydriatrics**,[1] relates to the application of water to the treatment of disease. It is used in contradistinction to the somewhat invidious term *hydropathy* (water-cure), employed by those who would make the use of water a separate and distinct system of treatment.

Balneology (Lat. *balneum*, a bath) is the science of baths and bathing, and *balneo-therapeutics*, though often used in a wider sense, is properly restricted to the use of baths for the relief of diseased conditions.

Minerals waters constitute an important addition to the *armamentarium medicorum*, and a description of these agents and their uses is a part of materia medica and therapeutics.

The earliest archives of the human race mention the use of waters for medicinal purposes. The primeval mythologies as well as the most ancient historical accounts refer to the bath as of supernatural origin. Bathing was practised among the Egyptians as a sacred rite, and it was made a religious duty by Moses. It was a common custom among the Israelites to "dip in Jordan" in order to be delivered from the scourge of leprosy and other hopeless diseases.

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[1] Sometimes improperly called hydriatics.

This rite, however, was invested with miraculous power, and no specific influence was attributed to the water itself, although mineral-water baths were certainly used among the early Hebrews. Josephus mentions the thermal baths of Calirrhoe near the Dead Sea, which were resorted to by Herod. Homer frequently speaks of baths among the early Greeks, and through Herodotus we are made acquainted with the intermittent spring near the temple of Jupiter Ammon. The historic pass of Thermopylæ received its name from the hot sulphur springs near by, which have been in active use over two thousand years. Œdipus, in the Island of Eubœa, was a favorite summer-resort of the ancient Athenians, and its sulphur baths are still in use. Although most of the nations of antiquity appear to have possessed baths, these were insignificant in comparison with the magnificent structures which sprang up in Rome after the completion of the great aqueducts. These have been fully described by Pliny, Tacitus, Seneca, and later Roman historians. Enormous establishments known as *thermæ* were erected by successive emperors, the most celebrated being those of Agrippa, 21 B.C.; Nero, 65 A.D.; Titus, 81 A.D.; Domitian, 95 A.D.; Commodus, 185 A.D.; Caracalla, 217 A.D., and still later those of Diocletian, 302 A.D. The technical skill displayed by the Roman architects in the various complex details of these luxurious baths was of the highest order. The Romans carried their love for this pastime to different parts of the world conquered by them, and whenever natural thermal springs or *stufæ* were found they were utilized for bathing, thus saving the expense of heating the water. One of the oldest and perhaps most famous of the Roman hot-spring resorts was at Baiæ, ten miles from Naples. In this charming and picturesque region, we are informed by Seneca, the wealthy Romans erected their villas, and during the summer months continued the gayeties of the capital, much as the opulent citizens of our own country do at Newport and Saratoga at the present day. Relics of Roman baths are still found at Bath, or Aqua Solis, in England, at Aix in Savoy and Aix in Provence, at Bagnères de Bigorre and Bagnères de Luchon in the Pyrenees, at Wiesbaden in Switzerland, and at Alhama and Caldas in Spain.

During the decline of the Empire the aqueducts were cut off by the Huns (about the fifth century), and many of the larger thermæ fell into decay. Still, bathing did not become entirely obsolete, and in the East it was kept in full vigor at Alexandria and at Brusa. Hot bathing and, more particularly, hot-air and vapor baths were adopted by the Mahometans, and the Saracens introduced them into Spain. After the commencement of the thirteenth century there were few large cities in Europe without hot-vapor baths. We cannot claim with certainty that the Turkish and Russian baths are merely the successors of the Roman baths. The principle of these baths has certainly been known to many races from a very early period of history. Thus, the Mexicans and Indians of America were found by European explorers to be using crude vapor baths. Their use was also understood to some extent by the ancient inhabitants of Ireland and Scotland, and the large vapor baths of Japan, now so extensively employed, are probably of independent origin. There are evidences that the Chinese resorted to baths for therapeutic purposes. During the present century the custom of bathing has developed to an enormous degree. All cities of importance and many smaller ones are supplied with the familiar Turkish and Russian baths; they are found in many clubs, and even some private residences are supplied with them. Bathing at spring-resorts for therapeutic purposes or for pleasure is carried to an extent never equalled before, while the custom of sea-bathing is well-nigh universal among seaboard populations during the summer months.

The medical annals of all ages refer to the use of mineral waters, either internally or by means of baths, as a recognized form of treatment. Thus, Hippocrates, in his treatise, *Airs, Waters, and Places*, prescribed rules for the treatment of acute and chronic diseases by water, which, it is interesting to note, are observed even at the present day. Asclepiades, Antonius Musa, Cornelius Celsus, Cœlius Aurelianus, and Galen were the most prominent early votaries of hydro-therapy. In almost every century we find the names of one or more enlightened and educated writers on the use of mineral waters amid the numerous quacks and charlatans who have clogged the wheels of progress in this field. Among the advocates of water familiar to the present generation of physicians may be found the names of Priessnitz, the Silesian peasant, who gave a great impetus to the hydriatric method; Latour, Fleury, Duval, Dujardin Beaumetz, Niemeyer, Baruch, Bartels, Jürgensen, and Winternitz. Perhaps the first work upon the qualities and uses of water published in this country was a volume entitled *The Curiosities of Common Water, or the Advantages Thereof in Curing Cholera, Intemperance, and Other Maladies*, by John Smith, C.M. This book was reprinted in Boston in 1725 from the London edition of 1712, and calls special attention to the "excellency of water as a drink," and enumerates some of its therapeutic attributes. Probably the pioneer work on American mineral springs was issued by Dr. John Bell in 1831. It was entitled *Baths and Mineral Waters*, and was followed in 1855 by a treatise on the *Mineral and Thermal Springs of the United States*, by the same author. In succession came the *Mineral Springs of North America*, 1873, by Dr. J. J. Moorman; *The Mineral Springs of the United States and Canada*, by Dr. George E. Walton, editions of which have appeared in 1873, 1874, and 1883, and the *Climatology and Mineral Waters of the United States*, by Dr. A. N. Bell, 1885. Brief compilations and enumerations of the American springs have been made by Dr. William Pepper, 1880; Dr. Judson Daland in Gould's *Medical Dictionary*, 1893, and Dr. Samuel T. Armstrong in Foster's *Reference Book of Practical Therapeutics*, 1897. The most complete enumeration ever attempted, however, was made by

Dr. Albert C. Peale under the auspices of the United States Geological Survey. Dr. Peale's report, which is frequently referred to in the course of this work, appears in *Bulletin XXXII. of the Geological Reports*, Washington, 1886. Reports on mineral springs also appear in various State geological works, and elaborate essays on the springs of Virginia, Georgia, Michigan, and California have been issued.

CHAPTER II.

ON THE ORIGIN OF SPRINGS AND THEIR SOURCES OF MINERALIZATION.

The Unit of Measure. Remarks on Thermal Springs, Geysers, Fumaroles, and Solfataras. The waters of mineral springs form a constituent part of the great aqueous circulation which exists in all parts of our globe. The water is evaporated from the surface, from the rivers, lakes, and seas, and, passing into the air, forms the rain-clouds, whence it is again precipitated to the earth. The greater portion is revolatilized or is drained away by the streams, and again enters the great natural reservoirs. A considerable quantity, however, sinks into the earth, and after an indefinite subterranean career reappears on the surface in the form of a spring. An examination will show that it has undergone various modifications in its dark ramblings through the nether world. The rain-water is quite pure, with the exception of a little ammonia, possibly nitrates and nitrites, and a small amount of carbonic acid, oxygen, and nitrogen gathered from the air. On its emergence as a spring, however, it may be impregnated with mineral ingredients ranging from mere traces to many thousand grains per gallon, and, moreover, it may be saturated with one or more gases.

Whence the source of this metamorphosis? It has been truly said that the table of contents of a mineral spring is but an index of the various geological strata through which it has passed and of the mineral bodies with which it has come in contact. "Water wears away a stone" is a trite but true axiom; it is the universal solvent. The rain-water, already containing a little carbonic-acid gas, which greatly enhances this solvent power, percolates through the upper strata of the earth, and, meeting there with the products of vegetable decomposition of past ages, small quantities of organic acids and an addition to its stock of carbonic acid, continues its way. Coming in contact with the igneous and metamorphic rocks, it abstracts from them its important mineral contents. Thus, passing through salt deposits the spring will contain chloride of sodium; filtering through iron ores, it becomes ferruginous, and permeating limestone or marble, the result is shown in the presence of calcium salts. Even the most refractory sedimentary rocks must yield their quota to the potent influence of the aqueous current. It is highly probable that chemical action and, in some localities, heat also are employed by nature in elaborating the components of the springs. These various ingredients are readily recognized by the analytical chemist as acids and bases and gases. These he combines according to certain accepted formulæ, and expresses the results as so many grains of sulphate of magnesia, carbonate of soda, etc., per gallon, or so many parts per thousand, as the case may be. The chemist's science, however, is not sufficiently exact to define the precise combination in which all of these ingredients occur, and in making his estimates he is obliged to resort to some extent to the arbitrary or empirical method. The correctness of the careful analyst's findings have been verified in the case of many different springs by the subsequent observations of the physiological action of the waters upon the bodily functions. It is to be regretted that a more uniform system of stating the components of mineral springs has not been agreed upon by our analytical chemists. An inspection of about one thousand analyses of American mineral waters shows that upward of forty different methods of expressing the results have been used. They range from parts per hundred to grains per gallon (imperial or United States); from grammes per litre to parts per million. Some give only the radicals actually found, while in many instances the analyses are only qualitative, with no attempt to determine quantities. To bring some degree of order out of this chaotic state of affairs, we have adopted in the course of this work the standard gallon of the United States, containing 231 cubic inches, or 58,372 grains of pure distilled water at a barometric pressure of 30 inches and a temperature of 62° F., as a unit of measure. The solids are presented as so many grains or fractions thereof, and the gases as so many cubic inches or fractions of a cubic inch, per gallon. It is quite true that the weight of a gallon of water varies a little at different barometric pressures and at varying temperatures, but this is not a consideration of paramount importance in this connection. Everyone is acquainted with the familiar gallon-measure, which equals eight wine pints. With the quantitative analysis before us and a knowledge of the capacity of the vessel from which the patient drinks, we can make, under any circumstances, a fairly close estimate of the amount of mineral water which he is taking. With the exception of a few very strong springs, concerning which specific instructions should always be given, it is not necessary to be absolutely exact in the dosage of mineral waters, and if the patient should imbibe a gill or two more or less than the amount prescribed, no harm is done. Perhaps two-thirds of the analyses of the American mineral springs already conform to this standard; those which do not have been converted in accordance with recognized rules. We present the following conversion table, arranged by Messrs. Leffmann and Beam, and published in their work on the examination of water for sanitary and technical purposes:[1]

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[1] Philadelphia, 1889.

Parts per 100,000 × 0.7 = grains per imperial gallon.
Parts per 1,000,000 × 0.07 = grains per imperial gallon.
Parts per 100,000 × 0.583 = grains per United States gallon.
Parts per 1,000,000 × 0.058 = grains per United States gallon.
Parts per 1,000,000 × 0.00833 = number of pounds per 1000 United States gallons.
Grains per imperial gallon ÷ 0.7 = parts per 100,000.
Grains per imperial gallon ÷ 0.07 = parts per 1,000,000.
Grains per United States gallon ÷ 0.583 = parts per 100,000.
Grains per United States gallon ÷ 0.058 = parts per 1,000,000.

The reduction from the imperial to the wine or United States gallon is made by multiplying by 0.833. To convert from the United States to the imperial gallon, multiply by 1.19.

Certain peculiar phenomena in connection with the formation of mineral springs remain to be described. These relate to *thermal* or *warm springs*, to *geysers* or *spouting springs*, and to fumaroles and solfataras.

A thermal spring is one whose temperature is higher than the average annual temperature of the circumambient atmosphere. Thus, a mineral water may be thermal in one portion of the country, while in other warmer regions it could not properly be so classified. For practical purposes, however, it is customary to term all springs above 70° F. as thermal, and those below as cold. Thermal springs having a temperature between 70° and 98° F. are designated as warm; those above 98° F. as hot springs.

Thermal springs are common in California and the States traversed by the Rocky Mountains, but much less so in the East and South. The only representative of this class found in the Middle or New England States is the Lebanon Thermal Spring of New York, with a temperature of 75° F. Several of the Saratoga springs have a somewhat higher temperature than the average heat of the air, but cannot be classed as warm. The Hot Springs of Virginia, 110° F.; the Warm Springs of the same State, 96° to 98° F.; the Hot Springs of North Carolina, 92° to 117° F.; the Warm Springs of Georgia, 70° to 90° F., and the Hot Springs of Arkansas, 76° to 157° F., are the principal members of this group east of the Rocky Mountains. The San Bernardina Hot Springs of California attain a temperature of 172° F., the Splendid Geyser of the Yellowstone National Park 199.8° F., while the Witches' Caldron and the Steamboat Geyser of Sonoma County, California, range from 212° to 214° F., their waters escaping in the form of steam.

The phenomenon of heat in mineral waters may be referable to one of several causes:

1. *The Interior Heat of the Earth.* It is a well-known fact, established by artesian borings and by the excavations of mines, that there is a rise in temperature as the descent becomes greater. This was once supposed to amount to one degree of temperature (F.) to every fifty-five feet of depth. Thus, a spring having a temperature of 100° in a locality where the average temperature of the air was

50°, was reckoned as proceeding from a depth of 2750 feet. The thickness of the earth's crust varies, however, and the downward increase of heat is not the same in all localities. We cannot, therefore, accurately judge of the depth of a spring by its temperature. According to Dr. Hallock, of Columbia College, New York, the deep well at Wheeling increases 1° to every 81.5 feet down to 3200 feet gradient; whereas in the last few hundred feet the increase is 1° to every 60 feet. Other factors also serve to render the depth of a warm spring uncertain. Thus, the water from low down may mingle with that from the colder strata above, or a vein supplying a well of moderate depth may have its origin far below. It is no doubt correct to attribute the heat of some of the less fervent thermal springs to the interior heat of the earth, but in most cases other influences are doubtless more potent.

2. *Chemical Action.* This is probably a source of heat in some mineral springs. It is well known that while certain chemical reactions have the effect of producing cold there are many which evolve a high degree of heat. Thus, sulphur may be oxidized to sulphur dioxide (SO_2), thereby giving rise to a considerable elevation of temperature. This substance dissolves in water, forming sulphurous acid (H_2SO_3), which is capable of still further oxidation and the formation of sulphuric acid (H_2SO_4), heat again being produced. If this powerful acid comes in contact with suitable substances, such as limestone or other carbonates, the ensuing reaction is attended by a still further liberation of heat. According to Dr. Winslow Anderson, chemical action may, under favorable conditions, raise the temperature of water to 212° F., or the boiling-point. It has not been clearly established, however, that this is a very fruitful source of the heat of the waters of mineral springs.

3. *Volcanic Action and Mountain Corrugation.* It is in these phenomena that we find the most efficient and satisfactory explanation of the cause of hot springs. By far the greater number of thermal springs throughout the world are found in volcanic mountain districts. Although active eruptions may not have occurred in hundreds, possibly thousands, of years, evidences of their former existence may still be seen in the presence of old craters, lava beds, etc. In such regions less violent, secondary phenomena, in the form of hot springs, geysers, and fumaroles, linger on to attest the slumbering fires within. Water coming in contact with these heated volcanic rocks far beneath the surface often attains a very high degree of temperature.

In the Rocky Mountain region, as well as in other portions of the far West, we have areas of more recent volcanic disturbance than that of the Appalachian in the East, and in these zones volcanic and igneous rocks are widely diffused. This fact accounts for the more frequent occurrence of hot springs in the Rockies than in the eastern section of the country. It has long been a well-known fact that the lines of junction between the sedimentary rocks and the older formations, especially along the bases of mountain ranges, are locations favorable for the development of thermal springs. These lines of junction are naturally weak points and feel the stress of an uplift first, and they are, therefore, the points at which the greatest number of fractures and fissures occur, thus giving exit to subterranean water-channels. When two or three axes of elevation cross each other the disturbance is greater, the fractures and fissures more numerous, and springs, consequently, of greater frequency.

Examples of this condition are found at Aix in France, Leuk in Switzerland, Mont Blanc, and other localities famous for their thermal waters.

It is to these two phenomena—viz., the presence of igneous and volcanic rocks to heat the water, and the occurrence of cracks and fissures to give it exit—that the existence of hot springs is due in a majority of instances.

Some cold springs are also associated with profound faulting of strata. Those at Saratoga may be taken as a prominent example. In this case, however, there is no connection with igneous rocks, and the water, which has its source primarily in the mountains to the eastward of the town, is probably tapped at too short a distance from the surface to have acquired a high degree of terrestrial heat.

The statement is commonly made that thermal waters are less highly mineralized than those of lower temperature. Some writers even go so far as to classify them among chemically indifferent or neutral waters. Not only is this idea fallacious, but, on the contrary, heated or superheated waters exert a far more powerful influence on most solids than do cold. Thus, it will be observed by numerous analyses in this work that many American hot springs are densely charged with mineral ingredients, and if others are but lightly so impregnated it is because the water in its journeyings failed to come in contact with rocks or strata containing soluble matter. Hot waters often deposit some of their mineral contents on cooling, forming at times quaint and fantastic shapes at their exits. The temperature of hot springs is usually persistent and invariable, but some of those due to volcanic action have been observed to present curious fluctuations. In one case cited by Peale,[1] viz., the Hot Springs of Salt Lake City, a considerable fluctuation of temperature has been noted. Ordinarily these springs show a heat of 122° F., but in 1889, for one month, June to July, and at irregular intervals in preceding years, the springs became as cold as 50° F.

Geysers. So called from the Icelandic word *geysir* or *geysa*, to gush, or to be impelled. These are peculiar spouting or intermitting hot springs, which take their name from the remarkable group in Iceland. In the Yellowstone National Park as well as in California we have equally wonderful exhibitions of these fantastic freaks of nature. Many theories have been offered to account for the formation of geysers, but that of Prof. Benson is now commonly accepted. It is as follows: In order to produce a geyser effect the outlet of the spring must consist of a natural tube, possibly of earth, rock, or deposits from the water itself, from forty to sixty or more feet in length, extending down into the earth. The tube being filled with water the pressure exerted on that at the bottom increases its boiling-point. Thus, while the water boils in the open air at 212° F., it would require a temperature of 251° F. to boil at the bottom of a tube at sixty feet of pressure. When a stratum of water at the bottom reaches this temperature it evolves steam, but the bubbles passing to the cooler water above are at once condensed. As the succeeding layers of superincumbent water become gradually heated to the boiling-point, the escaping steam bubbles are condensed in turn in the layers of water higher up. The time comes, however, sooner or later, when the entire column of water to the top of the tube or to the surface reaches the boiling-point, when much of the water throughout the entire tube is suddenly converted into steam, and the explosion occurs. Beautiful and impressive phenomena are often developed in this way. At some of the Yellowstone geysers the column of boiling water and steam is thrown to a height of 250 feet, this being accompanied by weird and sepulchral noises which reverberate through the surrounding earth. Some geysers observe absolute periodicity, so that the time of their eruptions may be foretold with exactness.

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[1] United States Geological Reports, 1892–93.

Prof. Tyndall has demonstrated the truth of the foregoing explanation of these curious springs by constructing a miniature artificial geyser in which all the conditions were carried out, the results on heating the water being identical with those described.

Several of the Saratoga cold-water artesian springs, notably the Champion and Geyser Springs, show an intermittent spouting character. According to Irwin,[1] these artificial geysers were produced by boring into the water cavity at a point below its highest part, thus leaving a kind of pocket above the level of the aperture in which free gas, of which the water contains a great quantity, collects. This continues until the tension becomes so great that forcible expansion takes place and the tube is siphoned out, as it were, and the process of aqueous and gaseous accumulation is renewed. Other intermittent springs owe their character to connection with the tides, to rainfalls, melting snows, etc. Some springs are frozen up all the winter and flow during the summer months. Others are peculiarly affected by seismic disturbances, great storms, etc. The American Carlsbad Springs of Illinois are said to become turbid after such perturbations even at remote points; the water remains red from an excess of iron for a short time, and then becomes acrid and harsh from a superabundance of alkaline ingredients.

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[1] Hydrotherapy at Saratoga, 1892.

Fumaroles. (Italian, *fumarola* from *fumo*, Latin *fumus*, smoke.) These are holes or small apertures in the earth seen in volcanic regions, from whence vapors issue. They are numerous at the geysers of Sonoma County, California.

Solfataras. So called from a dormant volcanic crater near Naples. The term solfatara refers to an area or to a phase of latent volcanic action characterized by the escape of steam, various gases and sublimates.[1] Such phenomena are observed at several of the hot spring localities in the far West.

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[1] Standard Dictionary, 1897.

CHAPTER III.

CLASSIFICATION OF MINERAL SPRINGS.

The importance of a proper classification of mineral waters is shown by the various tables and schemes which have been presented; almost every writer on the subject having his own peculiar method of designating the different varieties of these therapeutic agents. Considerations of a geographical, geological, therapeutical, or chemical character have been made a basis for the various groupings. In the days of Aristotle mineral waters were classified according to the vapors or gases they contained, or the predominant characters or qualities which appealed to the sense of taste or smell. Pliny, in the first century, divided them into acidulous, sulphurous, saline, martial, or chalybeate, nitrous, aluminous, and bituminous. Some of our modern classifications have advanced but little beyond these early schemes. An arrangement based upon the chemical ingredients of spring waters has found most favor, although a combined chemical and therapeutical grouping is in vogue in some countries. Geographical and geological classifications have not been used to any great extent by medical writers.

The following are examples of the principal classifications in use at the present day:

THE GERMAN CLASSIFICATION.[1]

- I. Alkaline . . .
  - Simple carbonated.
  - Alkaline.
  - Alkali and common salt.
- II. Glauber salt.
- III. Iron . . . .
  - Pure.
  - Alkaline and saline.
  - Earthy and saline.
- IV. Common salt . .
  - Simple.
  - Concentrated.
  - With bromine.
- V. Epsom salts.
- VI. Sulphur.
- VII. Earthy and calcareous.
- VIII. Indifferent.

THE FRENCH CLASSICATION.[2]

- I. Sulphur waters . .
  - With salts of sodium.
  - With salts of lime.
- II. Chloride of sodium waters . . . .
  - Simple.
  - With bicarbonates.
  - Sulphureted.

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[1] McPherson, John. The Baths and Wells of Europe. London, 1869, p. 94.
[2] Dictionnaire des Eaux Minerales. Paris, 1860, Tome i. p. 403.

III. Bicarbonated waters .	Bicarbonate of soda. Bicarbonate of lime. Mixed bicarbonates.
IV. Sulphated waters . .	Sulphate of soda. Sulphate of lime. Sulphate of magnesia. Mixed sulphates.
V. Ferruginous waters .	Bicarbonated. Sulphated. With salts of manganese.

THE AMERICAN CLASSIFICATION.[1]

(Mixed chemical and therapeutical.)

I. Alkaline waters . .	Pure. Acidulous (carbonic acid). Muriated (chloride of sodium).
II. Saline	Pure. Alkaline. Iodo-bromated.
III. Sulphur waters . .	Alkaline. Saline (chloride of sodium). Calcic.
IV. Chalybeate . . .	Pure. Alkaline. Saline (chloride of sodium). Calcic. Aluminous.
V. Purgative waters . .	Epsom salt (sulphate of magnesia). Glauber salt (sulphate of soda). Alkaline.
VI. Calcic waters . .	Limestone (carbonate of lime). Gypsum (sulphate of lime).
VII. Thermal waters . .	Pure. Alkaline. Saline (chloride of sodium). Sulphur. Calcic.

THE ENGLISH CLASSIFICATION.[2]

I. Simple thermal waters.
II. Common-salt or muriated waters.
III. Alkaline waters.
IV. Sulphated alkaline waters.
V. Iron or chalybeate waters.
VI. Arsenic waters.
VII. Sulphur waters.
VIII. Earthy or calcareous waters.

We meet with several difficulties in a study of the above schemes. For example, we cannot regard it as proper that an evanescent gas like sulphureted hydrogen should give the name of sulphur to a separate and distinct group of waters, as shown in each of the foregoing classifications. Many of the so-called sulphur waters of this country are used commercially, but the gas from which they receive their distinguishing designation is often entirely lost by volatilization before reaching the consumer.

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[1] Walton's Mineral Springs of the United States and Canada. 1872, p. 33.
[2] Herman Weber, in Allbutt's System of Medicine. 1896, p. 319.

More important defects, however, are found in the fact that none of these tables is sufficiently simple on the one hand or sufficiently comprehensive on the other. A truly scientific scheme ought to be broad enough to include any mineral water which may hereafter be analyzed. It is our belief that the following scheme of classification is applicable not only to our own waters but to all others, no matter from what part of the world they may come. With certain modifications, we are indebted for this tabulation to Dr. Albert C. Peale, of the United States Geological Survey.[1]

All mineral waters are divided primarily into two great groups: (1) Non-thermal or cold; (2) thermal; and are then treated precisely alike with reference to their chemical ingredients.

SCHEME OF CLASSIFICATION.

Group A. Non-thermal or cold springs.
Group B. Thermal springs.

Class I. Alkaline	Sulphated. Muriated.
Class II. Alkaline-saline	Sulphated. Muriated.
Class III. Saline	Sulphated. Muriated.
Class IV. Chalybeate	Alkaline. Sulphated. Muriated.
Class V. Neutral or indifferent.	

Peale gives the name "acid" to Class IV. to embrace a group of waters containing free sulphuric, hydrochloric, or silicic acids. We prefer to substitute "chalybeate," for several reasons:

(1) An examination of the various analyses will show that springs containing free acids are by no means common in the United States; (2) all those containing such acids also contain iron in considerable quantities; (3) iron springs are among the most common as well as the most valuable in our country; (4) iron is of more importance in mineral waters than free acids. This fact is shown by a glance at the classifications in vogue in different countries, all of which contain a chalybeate class of waters.

The existence or non-existence of gaseous contents may be expressed thus:

1. Non-gaseous.

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[1] Transactions of the American Climatological Association; also Fourteenth Annual Report of the United States Geological Survey, Washington, 1894, p. 66.

2. Carbonated or acidulous, containing carbonic-acid gas.
3. Sulphureted, containing hydrogen sulphide, etc.

If more than one gas be present, this fact may be expressed by a combination of terms, as sulpho-carbonated, etc.

Any classification must from the nature of the case be somewhat arbitrary. Nature herself is an evolution, and we find that waters so shade into each other that it is difficult to draw hard-and-fast lines. The above classification, however, admits of a ready subdivision according to the predominant solid constituents, as follows :

1. Sodic.
2. Lithic.
3. Potassic.
4. Magnesic.
5. Calcic.
6. Iodic.
7. Bromic.
8. Arsenical.
9. Silicious.
10. Manganic.
11. Acid.
12. Aluminous, etc.

A few words of explanation may be necessary to a full understanding of this grouping :

I. The alkaline springs include all those which are characterized by the presence of the alkaline carbonates, as the carbonates of the alkalies, the alkaline earths, and the alkaline metals. Generally, these waters are further distinguished by the presence of carbonic-acid gas, and may thus be additionally designated as carbonated. Nearly half the alkaline springs of the United States are calcic-alkaline—*i. e.*, they contain calcium carbonate or bicarbonate as a predominant ingredient. Take, for example, the soda spring at Manitou, Colorado. Its most important ingredient is sodium carbonate, sufficient to classify it as a distinctly alkaline spring; but it contains also large quantities of calcium carbonate and is abundantly charged with carbonic-acid gas. The water is, therefore, properly referred to as belonging to the alkaline-calcic-carbonated variety. Other ingredients are not of sufficient importance, or are not present in large enough quantities, to warrant their being expressed. However, if we wished to call attention to the minute quantity of iron present, it may be done by speaking of the water as an alkaline-calcic-carbonated-chalybeate, or as an alkaline-calcic-ferro-carbonated water.

II. The alkaline-saline waters include all those in which there is a combination of alkaline carbonate with the sulphates or chlorides on anything like equal terms. The Geneva Lithia Spring of New York may be taken as an example. This water contains as a predominant ingredient the sulphate of magnesia. It contains also considerable quantities of the carbonates of magnesia and lime, as well as the borate and sulphate of lithia. It is, therefore, properly styled an alkaline-saline water; or, if we choose to be more explicit, an alkaline-sulphated-saline-lithic water.

III. The saline waters include those in which sulphates or chlorides predominate. They are about one-third more numerous in the United States than alkaline waters. A majority of the springs usually classed as purgative or aperient would fall under the head of sulphated salines. Thus, a sodic-sulphated or a magnesic-sulphated could hardly be mistaken for anything else than a purgative water. A good example of the sulphated waters is that of the Crab Orchard Springs of Kentucky. It owes its virtues almost entirely to the sulphate of magnesia, and it may, therefore, be denominated a sulpho-saline-magnesic water, or simply as a magnesic-sulphated water. Under the head of muriated salines, all the brines would fall, as they are characterized by the presence of sodium chloride. Any of these springs may be sodic-sulphated or sodic-muriated, or calcic-sulphated or calcic-muriated. The sodic-muriated or chloride of sodium waters constitute 88 per cent. of the muriated saline springs of the United States. As a good example of this class may be mentioned the Empire Spring of Saratoga. Its chief ingredient is chloride of sodium, but it contains a considerable proportion of carbonate of lime, and some carbonate of magnesia. Like all the Saratoga springs it is abundantly charged with carbonic-acid gas. It is, therefore, classed as a saline spring, or in detail as a sodic-muriated-alkaline-calcic-carbonated spring.

IV. The chalybeate springs form a large and important class of our mineral waters. In all of them the iron is combined with the sulphates, chlorides, or alkaline carbonates. A few of them also contain free acids. We may, therefore, speak of muriated chalybeates, sulphated chalybeates, alkaline chalybeates, acid chalybeates, etc. In some instances, as in the Round Spring at Aurora Springs, Missouri, iron is the only ingredient of any consequence. These are referred to simply as chalybeates.

If a spring is densely charged with solid or gaseous contents it is spoken of as "strong" or "heavy," as a strong alkaline, a heavy saline, etc. If feebly mineralized, it is denominated "mild" or "light," as a mild chalybeate, a light carbonated water, etc.

V. Neutral or indifferent waters. There are a number of springs in this country widely known as resorts, and others extensively used in commerce, which cannot in a strict sense be included as mineral springs. Some of these contain not more than two or three grains of mineral ingredients to the gallon— less than most of our ordinary potable waters. These we would designate as neutral or indifferent waters. In this class are the well-known Poland Springs of Maine, the Glen Summit Springs of Pennsylvania, the Stafford Springs of Mississippi, and numerous others. It may be well to add that some of these waters are by no means neutral in a therapeutical sense. They are recommended by medical men who ought to be able to judge of their merits in a considerable range of disorders.

As cold or non-thermal springs are in a great majority, all those not refered to as warm or hot are considered as belonging to this group. (*Vide* Thermal Springs.) As Peale very properly remarks, the designation of a mineral water according to the scheme above outlined enables the physician at once to get a definite idea of its general chemical composition and to obtain a view of its probable medicinal value, after which a more careful study of its analysis will enable him in a large measure to determine whether or not it is likely to meet the requirements of any particular case. The need of a strictly therapeutical tabulation of our waters is thus to a great extent obviated.

CHAPTER IV.

GENERAL CONSIDERATIONS.

Do the waters which issue from the earth charged with chemical ingredients held in solution possess properties which may be made to serve a useful purpose in the therapeutic art? What part do they play and what position do they occupy to-day in our list of remedial agents? The inquirer will find among medical practitioners in the United States a wide-spread skepticism regarding their medicinal value. This incredulity is no doubt based, to a considerable extent, upon a somewhat justifiable prejudice; but may it not be due, in a much greater degree, to a want of correct information? We are all acquainted with the mineral spring advertising circular. It comes to us clothed in a respectable, even elegant dress; but it too frequently portrays the virtues of the alleged healing fluid which it represents in language of absurd hyperbole. When the intelligent practitioner reads that a certain water is positively curative in an imposing list of diseases, as set forth in divers pages of testimonials from renovated statesmen, restored clergymen, and rejuvenated old ladies, and then learns from the analysis that it contains two or three grains of lime-salts to the gallon, with the remaining ingredients requiring perhaps a third or fourth decimal figure to express, he can hardly be blamed for tossing the circular into his waste-basket, with an objurgation upon quacks generally and the mineral spring quack in particular; yet the conservative physician will find a safe and dignified position between that of the pretentious advertisement which claims everything and that of the medical skeptic who will believe nothing. It is quite incredible that all of the reputed useful effects procured from mineral waters, as reported by trusted members of our profession of all ages since Hippocrates, are the result of imagination or self-interest. Serious consideration will convince the unbiased observer that we possess in these agents a valuable addition to the materia medica. Another drawback to the scientific extension of mineral hydro-therapeutics is the indiscriminate manner in which these waters are used. At every spring resort during the season we find numerous persons drinking the waters of a perhaps powerfully mineralized spring without medical guidance. Many heavily impregnated commercial waters are also used in the homes of our citizens in an equally irresponsible manner. As Herman Weber[1] has justly remarked, it is very desirable that our profession should devote more attention to this important branch of treatment, and should diffuse a certain amount of wholesome knowledge on the subject among the laity. For this purpose a few lectures ought to be given regularly at our medical schools on hydro-therapeutics, as well as on climato-therapeutics, as a part of the course of materia medica. It may be stated, *imprimis*, that the sphere of mineral waters in medical practice is chiefly auxiliary or supplemental to other forms of treatment. Notwithstanding the impressive alphabetical list presented by some circulars, it will be seen that the class of affections to which they are properly applicable is in reality quite limited. It is essentially in chronic conditions that these agents find their greatest field of usefulness. To be sure, a saline purgative water will quickly remove the symptom of constipation, while one charged with alkaline carbonates will at once relieve acid eructations and pyrosis; but to overcome the fundamental vice underlying these phenomena patience and perseverance will be required. The use of the water, then, must be persisted in, not two or three days, but two, four, eight, or twelve weeks, as the case may be. It is a fact which few will deny that most persons visiting a spa during the summer months experience, almost from the beginning, an improvement in their physical condition, and in many instances return to their homes fully restored to health. This can be accounted for to a great extent by the change of air, food, and surroundings and the escape from the worry and cares of business. Perhaps numerous cases would do as well at summer resorts where there are no springs; yet, after a liberal deduction for all other assignable influences, we may justly attribute a large share of the good results to the aid rendered by a properly selected mineral water. An obstinate case of chronic constipation or catarrhal jaundice is not apt to yield readily to a mere change of diet and environment, and the same may be said of protracted cases of rheumatism, uric-acid gravel, and numerous other conditions. No doubt these changes and the use of the water supplement each other, and this explains the fact that mineral waters usually act with greater efficacy at the springs than when taken at home.

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[1] Allbutt's System of Medicine, 1896, vol. ii. p. 331.

In what way do mineral waters act, and how do they produce their therapeutic effects? We may answer this query by the statement that in a general way their influence is wrought in the same manner as is that of other medicinal agents. It is easy to understand that a water densely impregnated with the sulphate of magnesia will cause alvine evacuations, and that one containing iron will increase the amount of hæmoglobin in the red blood-cells; yet it must be confessed that an element of mystery still shrouds the action of many waters, and the good effects obtained from their use are difficult to explain. It is known that a mineral water containing a very minute quantity of the sodium or magnesium sulphate will often serve to overcome chronic torpidity of the bowels, while certain arsenical waters holding in solution less than $\frac{1}{100}$ of a grain of arsenic to the gallon will soon produce the characteristic physiological action of that powerful drug. It is also known that a very few grains of carbonate of calcium to the gallon will greatly increase the diuretic action of water. These effects cannot be produced by artificially adding these substances to water. The only explanation which can be offered for the more potent action of natural waters may be found in the fact that the mineral ingredients contained in them are in a state of combination which we cannot exactly simulate in a synthetic water. The combinations presented to us by the analytical chemist, while no doubt accurate in the main, or sufficiently so for practical therapeutical purposes, are nevertheless arbitrary or hypothetical, and we cannot produce them as they exist naturally. As Professor Oscar Liebreich[1] has observed, the analysis, even when made by the most careful chemist, frequently does not account for the full 100 per cent. of contents, but leaves a very large x unaccounted for of whose nature we have no idea. We prescribe mineral waters on account of their most prominent ingredients, but we cannot be perfectly sure that the substances present in smaller quantities do not play a more important part in the physiological action of the whole water than we generally concede to them.[2] Up to the present time, then, it must be confessed that we have no fixed scientific basis for mineral hydro-therapeutics. Our position is still largely empirical, and, notwithstanding the great improvements in the methods of chemical analysis, is based to a large extent upon clinical experience and observations; but with all our concessions as to a want of exact knowledge, the point must be yielded that in many obstinate and intractable conditions we have in the internal and external use of certain mineral waters a most efficient and valuable method of treatment, and that such waters may be credited with a wide range of therapeutic usefulness. Many of our lightly mineralized alkaline or calcic waters may be used *ad libitum* for club or household purposes; but no mineral water should ever be taken for its medicinal effects except upon the advice of a physician. Under these circumstances a careful examination should be made of the case, and if a change of climate and scenery, supplemented by the use of a mineral water, is indicated, let the patient consent to be guided by his medical adviser; and the latter, in selecting a resort for his patient, should thoughtfully consider the nature of the mineral water to be used, the character of the accommodations at the springs, the scenery, surroundings, height above the sea-level, prevailing meteorological conditions, etc. He should then send his patient to the spa with a letter to the resident physician, containing a history of the case and desirable suggestions regarding the purely drug treatment to be followed, the diet, etc. The local physician will thus be able at once to form a correct estimate of the case and to put the patient upon a proper form of treatment. If these rules were always followed the status of mineral hydriatrics with us would speedily rise from its present unsatisfactory standard to one resembling the dignity and importance it has long held in Europe.

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[1] Address before German Balneological Congress, 1893.

[2] Herman Weber, op. cit.

Commercial and Synthetic Waters. A word may be added here regarding the home use of mineral waters. These are of two classes: (1) The natural mineral waters, which are taken directly from the springs and shipped to the markets in barrels, carboys, demijohns, or bottles; and (2) the artificial or synthetic waters, which are prepared in the laboratory or manufactory, and charged with gaseous and solid ingredients to simulate, as a rule, the analysis of some well-known natural water for which they are named. Both classes of these waters undoubtedly occupy a useful sphere in our daily domestic life, and their use for table, club, and bar purposes in the United States has reached enormous proportions. Further than this, some of them occupy an important field of therapeutic usefulness; while, for reasons already mentioned, synthetic waters are not so reliable as those prepared in nature's laboratory, and while no bottled waters can approach in medicinal efficacy the use of the waters directly at the springs, it must be remembered that the season at such resorts is seldom prolonged beyond the three or four months of warm weather. Bottled waters, on the other hand, may be used all the year. The same general rules regarding the employment of mineral waters at the spas apply here. The mild bottled waters may be drunk *ad libitum;* but no mineral water, whatever its potency, should be taken for the relief of disease without the physician's advice.

CHAPTER V.

THE SOLID AND GASEOUS COMPONENTS OF MINERAL WATERS.

THE solid chemical ingredients of mineral waters are made up as follows:

- I. Common ingredients:
  - Acids: carbonic, sulphuric, hydrochloric, silicic, etc., usually in combination.
  - Aluminium: oxide and sulphate.
  - Calcium: carbonate, chloride, sulphate, phosphate.
  - Iron: carbonate, bicarbonate, oxide, sulphate.
  - Lithium: carbonate, bicarbonate, sulphate, chloride.
  - Magnesium: sulphate, carbonate, bicarbonate, chloride.
  - Potassium: carbonate, bicarbonate, chloride, sulphate, and phosphate.
  - Silicon: usually as silica or silicon dioxide; occasionally as the bicarbonate.
  - Sodium: chloride, carbonate, bicarbonate, sulphate.
- II. Rarer ingredients:
  - Acids: crenic and apocrenic, usually as crenates.
  - Ammonium: nitrate, chloride, crenate.
  - Antimony: as oxide and sulphate.
  - Arsenic: arseniate of sodium and potassium; arsenious acid.
  - Barium: as baryta or barium oxide and the sulphate.
  - Boron: as biborate of soda, or borax.
  - Bromine: as bromides of sodium, potassium, etc.
  - Cadmium: } as sulphate { very rare.
  - Cæsium:
  - Chlorine: as chlorides; rarely free.
  - Cobalt: } very rare.
  - Copper:
  - Fluorine: as fluorides in two or three springs.
  - Iodine: as iodides of sodium and potassium.
  - Lead: very seldom seen.
  - Rubidium:
  - Strontium: } very rare.
  - Zinc:

Besides the above-mentioned solids the following gases are commonly found in mineral springs:

Carbonic anhydride, or carbonic-acid gas.
Hydrogen sulphide, or sulphureted hydrogen gas.

Oxygen.
Nitrogen.
Carbureted hydrogen: very rare.

Almost all springs contain an appreciable quantity of organic matter. Besides the two organic acids above mentioned (crenic and apocrenic), three well-defined substances, known as baregine or hydrosin, glairine, and sulfuraria, have been identified. They will be described at the end of this section.

It may be said, without fear of dispute, that the most frequent, as well as the most important, component of a mineral spring is water itself. Aside from its absolute necessity to the preservation of all forms of life, this agent possesses certain very important therapeutic properties, some of which may be considered at this time. When ordinary pure water is swallowed it is almost immediately taken up by the radicles of the gastric veins, passing directly to the liver, and from thence into the systemic circulation. Its manifold functions in the body are fully treated of in the works on physiology. For our purpose it is sufficient to notice its influence on the emunctories. Water is actively diuretic, not only increasing the liquid flow of the urine, but if taken in large quantities greatly augmenting the amount of solids—urea, uric-acid, etc.—escaping from the system in any given length of time. It thus aids in the process of metabolism or tissue metamorphosis, and may be said, so to speak, to "flush the system." It also dilutes the urine, renders it lighter in color and specific gravity, and sometimes relieves it of irritating qualities. Water in large quantities thus becomes useful in certain kidney diseases, characterized by stagnation of the renal circulation and suppression of the urine. It is also valuable in acid states of the urine, characterized by scalding on urination and a frequent desire to empty the bladder, symptoms which are observed in numerous affections of the genito-urinary passages. In warm weather water is also diaphoretic, and, aside from its grateful, cooling, and refreshing effects, it thus has some influence as an antipyretic in febrile states of the system. According to Maillart, of Geneva,[1] typhoid fever may be treated internally by copious draughts as a definite method. Five to six quarts may be administered daily during the whole of the febrile period, and there are no contraindications. The good results which have been observed are no doubt due to oxidation of the toxins and refuse material, which are thus rendered soluble and eliminated. When taken cold in considerable quantities, water also stimulates the peristaltic action of the small intestines, and thus has a certain cathartic influence. The various local uses of water in almost every department of medical and surgical practice are too familiar and too numerous to be described here. Some of them will be considered in the chapter devoted to balneo-therapeutics. The therapeutic effects of water are modified by the presence of its mineral and gaseous contents, and it is on account of the presence of one or more of the substances now to be described that a hydriatric course of treatment is inaugurated. It is not proposed to enter into a detailed account of the physiological actions and therapeutical uses of these various bodies, but simply to refer to them in their relations as constituent parts of mineral waters.

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[1] Revue de Méd., March, 1894.

Acids. Numerous acids occur in mineral waters, but they are seldom found in a free or uncombined state, being, as a rule, united with one of the metallic bases—sodium, potassium, iron, etc.—to form salts. However, a number of our springs contain sufficient quantities of free acid to impart certain distinguishing characteristics to the water. Notable examples are the Oak Orchard Springs, of New York, the Matchless Mineral Wells, of Alabama, and the Texas Sour Springs. These acid or sour waters should not be confounded with those termed acidulous, which derive their name from the presence of carbonic acid. Most of the sour springs contain free sulphuric acid. Free hydrochloric acid has been found in several of the Yellowstone Park Springs; but, in common with phosphoric and silicic acids, it is very rarely observed uncombined. Almost all of the sour springs contain large quantities of other ingredients, especially iron and alum, which increase their therapeutic applicability. Being very astringent, the stronger acid waters are useful in relaxed states of the mucous membrane, especially when characterized by diarrhœa and dysentery. They have also been used with good effect in hæmoptysis, colliquative sweats, and in depraved and impoverished conditions of the body due to intemperance or specific diseases. They also have an extended local field of usefulness, being employed with good results in leucorrhœa, pharyngitis, and conjunctivitis, and in superficial ulcerations.

Aluminium. This substance is found in springs in the form of the oxide, or alumina, and of the sulphate. It occurs in variable quantities, ranging from a mere trace to sixty or eighty grains per gallon, as seen in some of the Virginia alum springs. The sulphate is almost always present in the sulphureted chalybeate waters, and, as stated above, in the acid springs. The internal use of alum waters is generally governed by these associated ingredients. Some of the alum springs have acquired a considerable reputation in scrofulous diseases and in chronic diarrhœa and dysentery. The iron-alum waters are beneficial in passive hemorrhages and in exhausting night-sweats. Locally, their astringent action calls them into service in much the same class of cases as are benefited by the acid waters. They have produced valuable results in conjunctivitis, stomatitis, chronic vaginitis, and other relaxed or inflammatory states of those portions of the mucous surfaces accessible to local treatment. They have also been found to act as a useful auxiliary in the treatment of ulcerated surfaces, abrasions, etc. In large quantities the alum waters have a laxative influence, but they are seldom used in virtue of this action.

Ammonium. This element, in the form of the chloride and carbonate, is found in a few of our mineral springs, but in quantities too minute to add to their medicinal value. The nitrate and nitrite are usually present in combination with the organic matter of mineral waters, but are properly classed among the undesirable ingredients, or impurities. (*Vide* Potable Waters, Appendix.)

Antimony is found in small proportion in several of the Virginia springs, but it does not appear to have been called into use in this connection, although it is believed to increase the alterative power of the water in two or three instances.

Arsenic occurs in several of the American mineral springs, usually as the arseniate of sodium. Though existing in minute quantities, the well-known physiological effects of this powerful substance may be quickly produced by the imbibition of mineral waters containing it. When taken internally, arsenic promotes the appetite and digestion and improves the body nutrition. It lessens the excretion of carbonic acid, and probably also of urea: in other words, it checks retrograde tissue metamorphosis. It also increases the secretion of the gastro-intestinal mucous membrane and hastens the peristaltic movements. Arsenic also possesses in a marked degree the peculiar influence upon the nutrition and the general bodily functions which we express under the term alterative. In virtue of these actions the arsenical waters may be used with confidence in a considerable variety of disorders. They are highly extolled in anæmic states, especially when accompanied by dyspepsia and catarrh of the bile-ducts. They are also used with success in menorrhagia and other uterine disorders in the female, and in functional impotence in the male. In large doses they have been found useful in chronic malarial toxæmia after quinine has failed. They are likewise recommended for the cachexias resulting from syphilis, phthisis, and scrofula, and for neurasthenia. Perhaps the most striking results from the use of arsenic have been observed in chronic skin diseases of the squamous variety, especially eczema and psoriasis. To a lesser extent it is also useful in old, long-standing cases of pemphigus and acne. Without mentioning the numerous additional uses of this drug, it may be said that some of our arsenical waters appear to meet the therapeutic indications more promptly, with more permanent results, and with less constitutional and local irritation than the artificial preparations of arsenic.

Barium. This element is present in the earth baryta, consisting of one atom each of barium and oxygen. It is found in very small quantities in a few of our mineral springs. Its medical properties have never been fully investigated, but its effects on the system are believed to be somewhat analogous to those of arsenic. The solution of the chloride of barium (U. S.) is deobstruent and anthelmintic, and may possibly prove useful as a heart stimulant. There is some reason to believe the barium salts to possess value in the treatment of nervous sclerosis and of cancerous, scrofulous, and other morbid growths. As an ingredient of mineral waters, however, its quantity is too small to give promise of much remedial value.

Borax, or biborate of soda, is present in a few mineral waters, and boric acid is also occasionally found. Borax springs are quite common in California, where this substance is a staple article of commerce. The therapeutic usefulness of the borated waters is not extensive. Their action on the stomach is that of an antacid, but they are seldom used for this effect. They are admissible, however, in cases of renal and vesical catarrh depending upon the uric-acid diathesis. As borax has some emmenagogue and ecbolic influence, the waters are worthy of a trial in catamenial irregularities. They may also be tried in epilepsy. The borax waters are useful locally as a gargle in clergyman's sore-throat and pharyngitis; as a lotion, by means of the eye-cup, in conjunctivitis, and as a douche in vaginal and uterine catarrhs.

Bromides and Iodides. Bromine is found in some of the American mineral springs combined with sodium, potassium, and magnesium, in the form of bromides. Similar salts of iodine are usually coexistent, so that these components of mineral springs may be described together. The saline springs of New York, Michigan, and Missouri usually contain traces of these substances. The "Deer Lick" Spring at Glen Springs, New York, is one of the best examples of the so-called iodo-bromated waters, resembling the European springs at Duerkheim, Kreuznach, and other spas. There are also several of these springs in California, near the Pacific coast. Iodine is most frequently found as the iodide of sodium, bromine as the bromide of magnesium. The general effect of these waters may be described as alterative; they promote tissue metamorphosis, and have thus been used with benefit in cases of chronic exudations, old gunshot-wounds, glandular swellings, hypertrophy of the spleen, ovaries, etc., and in tertiary syphilis. Great benefit is also observed in chronic mercurial and saturnine poisoning. The bromides are believed to combine with the metals, forming soluble compounds, which are more easily eliminated from the system. The bromated waters are also given to allay nervous irritation, but they are not equal to the iodides in alterative influence. The speedy curative effects of the iodides are sometimes evinced in a remarkable degree, although they may be present in the springs only in minute quantities. Indeed, certain iodide springs were celebrated for the cure of scrofula, obesity, goitre, etc., long before the presence of these salts had been ascertained. The iodo-bromated waters are further recommended in certain respiratory disorders—chronic bronchitis and asthma—as well as in rheumatism, gout, and chronic Bright's disease. Their effects are usually modified or enhanced by the other chemicals which are almost always coexistent, viz., the chloride of sodium and ferruginous salts. They consequently have a very wide range of applicability in practical medicine.

Cadmium has been detected in several of the Virginia springs, but so far as known this substance has no internal medicinal application. Its action has been supposed to be similar to that of zinc, and as such it has been used in solution as a lotion for external purposes. Traces of *cæsium* have also been discovered by spectrum analysis in several mineral waters, but this element seems to have added nothing to their medicinal value. The same may also be said of *cobalt* and *copper*.

Calcium. The salts of lime are among the most constant constituents of mineral waters. They occur as the carbonate or limestone, the chloride, the sulphate or gypsum, and the phosphate. It is the sulphate of lime which gives the property of hardness to many of our ordinary drinking waters, unfitting them for washing purposes. Lime is an essential constituent of the human body, about two pounds existing in the bones of the normal adult. Its loss in children gives rise to the condition known as rhachitis or rickets. It also enters into the composition of the brain-substance—nerves, blood, muscles, saliva, and other tissues and fluids. The carbonate of calcium will be described under Carbonic Acid and the Carbonates.

The chloride of calcium is very soluble, and is frequently found in mineral waters. It is apt to be combined with the chloride of magnesium, from which it is very difficult to separate. It has tonic and deobstruent effects, and appears to promote in some degree the secretion of urine, perspiration, and mucus. The muriated calcic waters may be used in scrofulous diseases and in chronic eczema and impetigo connected with a lymphatic temperament.

Phosphate of calcium. This is an exceedingly insoluble substance, and consequently does not exist in mineral waters in quantities sufficient to prove of much value. In very large doses the phosphate of lime waters might be of benefit in phthisis, mollities ossium, and other conditions where the lime-salts of the body are deficient.

The sulphate of calcium is soluble in about 460 parts of water, hot or cold. It is employed by surgeons in the form of plaster-of-Paris, but has no internal application.

CHAPTER VI.

THE SOLID AND GASEOUS COMPONENTS OF MINERAL WATERS.—(*Continued.*)

Carbonic Acid and the Alkaline Carbonates and Bicarbonates.

MOST cold mineral springs contain carbonic-acid gas in greater or less proportion. They thus become carbonated waters unless some other ingredient is sufficiently prominent to fix its own character upon the water. Those containing an excess of this gas have an acid reaction when first drawn, and an acidulous, pungent, but very agreeable taste. It gives to water a bright and piquant sparkle, and is the gas used in charging all of our synthetic artificial waters —"seltzer," "soda," "vichy," etc. It is also present in many wines. In moderate doses carbonic acid promotes the flow of saliva, tends to allay nausea and gastric irritability, aids digestion, assists in rendering the fluids of the body alkaline, promotes diuresis, and imparts a sense of well being. The carbonic-acid waters are often better borne by the stomach than any other form of drink, and they form a pleasant medium for the administration of milk to fever patients.

The Alkaline Carbonates give character to the important alkaline group of mineral waters. They consist of the carbonates of calcium, iron, lithium, magnesium, potassium, and sodium. They are frequently associated with carbonic acid, which, greatly increasing their solubility, forms with them the bicarbonates. These salts have so many characters in common that it seems proper to consider them in one group, afterward observing their individual properties. Though apt to be acid in reaction when first taken from the fountain, owing to the presence of carbonic anhydride, yet their action in the system is always that of alkalies. They form a very efficacious and speedy remedy in the treatment of acid dyspepsia and flatulence. They also act as stomachics, if given before meals, by stimulating the peptic glands. Having a diuretic tendency, the alkaline carbonated waters tend to correct acidity of the urine, and are of great service in fevers, rheumatism, gout, vesical irritation, diabetes, etc. In Europe they have long held high favor in the treatment of metritis and leucorrhœa, as well as other female pelvic disorders. When combined with salines, as they often are, forming the great alkaline-saline group of waters, they are of much value in catarrhal conditions of the gastro-intestinal tract with engorgement of the portal system. They have further been found useful in obesity. When associated with iron, constituting the much-prized alkaline-chalybeate group, the range of their action is manifoldly extended (*vide* Iron).

Carbonate of calcium. The familiar "chalk mixture" of the drug-stores is largely composed of this substance. It possesses several properties not observed in the other carbonates. Although alkaline in action, it is not evacuant, but in large doses is apt to cause constipation. In virtue of this action the calcic waters have been used with much success in chronic diarrhœa. There is also reason to believe that uric-acid gravel and calculi may be disintegrated and eliminated under their free use.

Carbonate of iron (*vide* Iron).

Carbonate of lithium. The carbonate of lithium is sparingly, the bicarbonate freely, soluble in water. Solutions of lithia are alkaline. These salts are found in a considerable number of our mineral waters in various proportions. Some of those most extensively advertised contain less than half a grain to the gallon, and may be regarded as practically inert so far as this substance goes. Lithia owes its virtues to the fact that it unites readily with uric acid, forming the urate of lithia—a freely soluble compound which passes readily from the system. For this reason it finds its most important application in diseases characterized by the uric-acid diathesis, otherwise known as uricæmia, lithæmia, or lithiasis. It is notably useful in cases of uric-acid sand, gravel and calculi, and in gout and rheumatoid arthritis. It is also stated to be of value in phosphatic deposits in the appendix, and in concretions, tophi, etc.

Carbonate of magnesium. This is perhaps the most efficient of the antacids. It is mildly alkaline in reaction. Perhaps its best effects are observed in acid eructations and pyrosis, and in sick headaches, especially when due to or accompanied by constipation. It is also of value in checking the formation of uric-acid gravel and calculi.

Carbonate of potassium. This salt is usually found in the form of the bicarbonate. It possesses antacid, diuretic, and antilithic effects in connection with the other alkalies, but claims no individual or peculiar virtues.

Carbonate of sodium. The carbonate of sodium may be taken as the standard of the alkaline carbonates found in mineral waters. This salt, or the bicarbonate, occurs with greater frequency, and, as a rule, in larger quantities than the other compounds of this character. In the body it is found in the blood and saliva, giving to these fluids their alkalinity. It also occurs in the urine, the lymph, the cephalo-rachidian fluid, and in bone. Its function in nutrition is rather accessory than essential. Waters containing the carbonate or bicarbonate of soda may be used whenever an alkaline water is indicated, as these salts possess most of the virtues of the group.

The Chlorides. These salts furnish the active ingredients of the muriated saline waters. They occur in about the same combinations as do the carbonates, viz., the chlorides of calcium, iron, lithium, magnesium, potassium, and sodium.

The chloride of sodium is the most universal of these salts, and it is found in almost all mineral waters, ranging from mere traces to several thousand grains per gallon.[1] It is one of the essential components of the body, being found in every structure except the teeth. A certain daily quantity is required for the needs of the system, and its withdrawal is at once keenly felt. It exercises its chief functions in the fluids, and determines to a great extent the quantities of exudations, regulates absorption, and serves to maintain the albuminoids, especially those contained in the blood, in a state of fluidity. It is, in a word, one of the most important factors in the process of nutrition. The experiments of Bischoff, Voit, and Kaupp show, further, that an increased supply of chloride of sodium causes an augmentation of the amount of nitrogen excreted through the urine.

The chloride of sodium or muriated saline waters, when taken into the stomach in therapeutic doses, cause an increase in the flow of gastric juice, bile, pancreatic juice, and intestinal fluid, promote the appetite, and aid in the process of digestion. They have a mild aperient effect, and have an antiseptic influence on the intestines, preventing or tending to prevent putrefactive changes. Salt promotes tissue metamorphosis, as shown by an increase in the quantity of urea excreted. The mucous secretion of the bronchial tubes is also increased, giving to this substance some expectorant influence.[2] According to Spillman, the chloride of sodium is somewhat sedative to the nervous system.

In virtue of their physiological action, the muriated sodic waters are of great value in gastric, hepatic, and intestinal disorders. In addition to the chloride of sodium, they almost always contain valuable alkaline ingredients, and frequently ferruginous salts, which greatly extend their therapeutic applicability. It would be difficult to mention a chronic affection involving the stomach, liver, or intestinal tract in which one of the muriated saline waters could not at some stage be beneficially exhibited. According to Herman Weber, they are to be preferred even to the bitter or sulphated saline waters in portal and pelvic congestion in thin or spare persons, where emaciation is to be avoided.[3] Their special application, however, is to be found in atonic dyspepsia, insufficiency of the digestive fluids, giving rise to dry, scybalous stools, a furred tongue, disagreeable taste in the mouth, loss of appetite, hebetude, and malaise. These waters are also applicable to some extent in chronic bronchopulmonary affections with a scanty, tenacious expectoration.

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[1] Some of the Michigan saline springs present from 10,000 to 13,000 grains of sodium chloride to the United States gallon.

[2] Vide article by the author in the Medical Record, February 22, 1896, p. 261.

[3] Allbutt's System of Medicine, 1896, vol. i. p. 323.

The chloride of potassium usually coexists in mineral springs with chloride of sodium, though in much smaller quantities. It is also less generally distributed in the body, where its functions appear to be analogous to those of the sodium salt.

Chloride of magnesium is also frequently found in saline mineral waters. It forms the bittern of salt works, and occurs in great quantities in the waters of the Dead Sea and in some of the brines of New York and Michigan. It is also present in considerable proportion in sea-water. This substance promotes the flow of bile, acting mildly as a purgative and increasing the appetite.

Chloride of calcium (*vide* Calcium).

Chloride of iron (*vide* Iron).

Chloride of manganese (*vide* Manganese).

Chloride of rubidium. This may be classed as a chemical curiosity. It is found in minute quantities in a few springs, and is supposed to possess properties resembling those of the chloride of potassium.

Chloride of lithium is found in small amount in several springs. It possesses no therapeutic properties apart from those which have been considered under Carbonate of Lithium.

A small amount of *free chlorine* is stated to exist in a few mineral waters, but it does not seem to have increased their therapeutic efficacy.

Fluorine also appears in several analyses, but in quantities too minute to entitle it to consideration.

Hydrogen sulphide or sulphureted hydrogen gas. This gas is an important constituent of a large number of our most valuable cold and thermal springs. It occurs most frequently in a free state, but is sometimes found in combination as sulphides with sodium, potassium, calcium, or magnesium. This substance imparts to its waters their peculiar odor of decayed eggs, which, at some springs, may be noticed at a considerable distance if the wind is favorable. The hot sulphureted springs are most frequently observed in mountainous or volcanic regions, and contain sulphates of a number of the elements, and occasionally sulphides and sulphuric acid. Many of them are also strongly impregnated with chloride of sodium. When coming in contact with air these waters usually present a milky appearance, owing to a precipitation of the sulphur, the hydrogen of the compound passing into the atmosphere. Sulphureted hydrogen is an irrespirable gas, and when inhaled in considerable quantities is quickly fatal. Its activity when taken into the stomach in mineral waters is open to some doubt. Dr. Moorman,[1] who observed the effects of the sulphureted waters for many years at the Greenbrier White Sulphur Springs, looked upon it as possessing an alterative action equal to that of mercury in syphilitic diseases. It cannot be disputed that these waters promote the activity of the bowels and kidneys. They are highly advocated by medical practitioners of experience in rheumatism, gout, chronic synovitis, white swelling, and many skin diseases. Many of the sulphur springs are celebrated in the treatment of chronic malarial infection accompanied by an enlarged spleen and liver, and in hepatic congestion, abdominal plethora, and hemorrhoids. They have also been found useful in certain female pelvic disorders, especially in chronic uterine inflammations. The vaunted efficacy of sulphureted hydrogen gas in phthisis has been shown to possess no basis in fact. It is probable that the older writers also overestimated the cholagogue influence of this substance. We may readily believe that not a few of our well-known sulphur springs owe their celebrity more to other coexisting ingredients than to the sulphureted hydrogen which they contain. In the form of bath, *q. v.*, the sulphureted waters also possess an extensive sphere of application.

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[1] Mineral Springs of North America.

Carbureted hydrogen. This gas sometimes occurs in mineral springs in coal regions and in natural-gas districts. It has no therapeutical value and renders water unfit for medicinal purposes.

Iodine (*vide* Bromine and Iodine).

Iron. This element forms the base of the numerous and important waters of the chalybeate group. In the body it is present as an essential element of hæmoglobin, the coloring matter of the blood and the great oxygen-carrying and distributing agent. Iron also occurs in the lymph, chyle, gastric juice, pigment of the eye, and in traces in the urine. It is also a constant constituent of milk and eggs. The loss of even a small proportion of the normal quantity of iron in the blood is quickly shown by the pallor of the countenance and other symptoms of anæmia which are produced.

Iron is, perhaps, most often found in springs as the bicarbonate, although many analyses show the sulphate, a few the oxide, and others the chloride.

The bicarbonated chalybeate waters are usually most valuable for internal administration. Not only does carbonic acid increase the solubility of the iron, but it disguises its otherwise astringent and ferruginous taste, and aids in its speedy absorption and assimilation. These waters prove of great value in cases of anæmia or poverty of the blood. Clinical experience has shown that they cause an increase in the appetite, a return of the normal color, a gain in weight and strength, and a general improvement of the bodily functions. Investigations with the hæmoglobinometer have further proved that the deficiency of the coloring-matter of the blood observed in anæmic states may be readily made up by the administration of a carefully selected chalybeate water. It matters not though the iron be present in small quantities, and few of the carbonated iron waters contain more than five or six grains per gallon. The blood contains normally about forty-five grains of iron, and this quantity cannot be permanently increased by consuming large quantities. It is probable that the deficiency, no matter how produced, never exceeds fifteen or twenty grains.

An excess of what is actually required, therefore, only defeats its object by disturbing the digestion, exciting the cardiac action, and producing disturbances of the cerebral circulation, mental confusion, and dizziness. A chalybeate water containing not more than one grain to the gallon will speedily show its influence in the returning color and increased tone and vigor of the system.

The indications for the use of the iron waters are numerous. It may be said that they serve a useful purpose in almost all debilitated states of the system accompanied by a loss in the hæmoglobin of the blood. In slow convalescence from acute diseases, the anæmic states resulting from a severe operation or difficult confinement, in all forms of hemorrhage not due to fulness of the vessels or fragility of their coats, in amenorrhœa when due to chlorosis, in the debilitating catarrhs of the uterus and vaginal mucous membrane, and in the various cachexias the chalybeate waters may be confidently expected to render valuable aid.

It is interesting to note, as Dr. Irwin[1] observes, that the more recent and direct is the cause of an anæmic state the more readily is the iron taken up and assimilated to the wants of the system. Iron waters should be taken guardedly by stout, red-faced, plethoric persons. They are directly contraindicated in vertigo or rush of blood to the head, and in all cases where there is reason to suspect the integrity of the bloodvessels. The iron waters are best taken half an hour to an hour after meals, in doses ranging from a wineglassful to a tumblerful, according to the strength of the water and the weight of the patient. The gastric mucous membrane is at this time in the best condition to absorb and assimilate it. In severe cases, however—such, for example, as pernicious anæmia, leucocythæmia, and extreme debility—when we wish to exert a speedy influence, they may be taken every three hours. The milder iron waters may be consumed *ad libitum*.

The chloride of iron is not often found in mineral waters, and then in very small amount.

The sulphate of iron is found in large quantities in a number of our springs. All of the acid and most of the sulphur springs are rich in this salt. The sulphate of iron waters have excellent properties as astringents and tonics, but they are not so palatable nor so well adapted for general use as the carbonated chalybeates.

Lead. The presence of traces of lead will be noted in several analyses in this work. It has no medicinal application as a constituent of mineral springs.

Lithium. (*Vide* The Alkaline Carbonates.)

Magnesium. (*Vide* Carbonate of Magnesia, Sulphate of Magnesia, etc.)

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[1] Op. cit.

Manganesium. This element in the form of the oxide, the carbonate or bicarbonate, and the sulphate has been detected in a few of our American springs. From the circumstance that it exists normally in the blood, it was supposed that it might, like iron, play an important part in the human economy. Manganese promotes the flow of bile, is somewhat emmenagogue, and undoubtedly possesses some reconstructive and tonic properties. In the latter sphere of its influence it is probably a useful auxiliary to iron in several springs, but its claims are not such as to entitle it to an important place in therapeutics.

Nitrogen and oxygen. These gases, as occurring in mineral waters, have no medicinal application. Several of the combinations of oxygen—oxide of iron, oxide of alumina, etc.—have been mentioned.

Potassium. (*Vide* Carbonate of Potassium, Sulphate of Potassium, etc.)

Silicon. This element is a very common constituent of mineral waters. It occurs in the form of silicon dioxide, or silica. Potassium, sodium, and magnesium silicate, and silicic acid are also noted in several analyses. Silica appears to have some value when taken internally in cancer and lupous ulcerations, according to Dr. Piffard, of New York.[1] It is also stated that albumin and sugar have been caused to disappear from the urine by its use. As a constituent of mineral waters, however, no advantage seems to have been taken of its rather hypothetical virtues.

Sodium. This element is described under its combinations (see the Sulphate, the Carbonate, etc.).

Strontium is found in traces in several springs. Its medicinal application is very limited. Being an intestinal antiseptic, however, it is possible that considerable quantities of the strontiated waters might be found useful in flatulence, intestinal torpor, summer diarrhœa, etc.

The Sulphates. Several of the sulphates have already been spoken of. Those now to be considered are the sulphates of potassium, magnesium, and sodium. The action of the former salt is quite analogous to that of the two latter. It is usually found in very small quantities, however, so that the important class of sulphated salines, or bitter waters, may be said to owe their activity almost entirely to the sulphate of magnesia, or Epsom salt, and the sulphate of soda, or Glauber's salt. The sulphate of soda is a white crystalline powder, bitter and rather nauseous to the taste. It is freely soluble in water, and is one of the most frequent constituents of our mineral springs. The sulphate of magnesia occurs when isolated as a transparent crystalline salt, also bitter, nauseous, and saline, and exceedingly soluble. Both of these salts are laxative or purgative in effect, according to the dose taken. They act by promoting the process of endosmosis and exosmosis, thus abstracting the watery elements of the blood and increasing the intestinal secretions. The observations of Rutherford and Vignal show that the sulphate of soda is also a valuable hepatic stimulant, the effects of the magnesia salt appearing to be confined chiefly to the intestinal glands. Both increase the urinary flow. Waters containing exceedingly small quantities of these salts tend to promote regularity f the bowels when taken continuously. Their best effects are observed in disordered conditions of the stomach, liver, and bowels, with the concomitant symptoms of constipation. In sluggish states of the liver, characterized by a sallow countenance, yellowness of the conjunctiva, coating of the tongue, and hemorrhoids, the sulphated saline waters are speedily efficacious. In eliminating the various chronic infections from the system, scrofulous, syphilitic, and malarial, as well as in expelling lead, mercury, and other metallic poisons, they furnish an important and useful application. They are likewise of considerable value in promoting the absorption of pleuritic and peritoneal transudations. They are, further, believed to be useful in corpulency in virtue of their accelerating influence on tissue changes. In organic cardiac disease accompanied by œdema of the lower extremities, with threatened general anasarca, these waters are of great service in relieving the engorgement of the peripheral circulation and partially removing the strain on the heart. The value of a brisk saline will be generally acknowledged in the "rocky" state following alcoholic excesses. When combined with the alkaline carbonates forming the important alkaline-saline group of waters, or with iron producing the useful saline-chalybeates, the sphere of their therapeutic efficacy is greatly extended. For a purgative effect the sulphated sodic and magnesic waters are, as a rule, best taken on an empty stomach, before breakfast, and followed by a brisk walk in the open air. As laxatives they may be taken in smaller doses, but, as before, on an empty stomach. The lighter salines may be drunk or used for the table *ad libitum.* The fact must be remembered, however, that while, as a rule, these waters act as mild, certain, and speedy aperients, they fail absolutely in some cases, and occasionally appear to produce the contrary effect of constipation. Several of the author's own patients, while sojourning at Carlsbad and imbibing daily considerable quantities of the rich saline waters at that well-known spa, have found it necessary to resort to mercurial or vegetable purges. These waters are apt to act injuriously in chronic inflammatory or cancerous states involving the stomach, peritoneum, or intestines. They are, likewise, to be used cautiously in cases of extreme anæmia and great debility.

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[1] Foster's Reference Book of Practical Therapeutics, 1897, vol. ii. p. 191.

Zinc. The presence of zinc in small amount will be observed in several analyses of American mineral springs. It does not appear to have influenced their medicinal uses in any way.

Organic Ingredients. As previously stated, water when passing through the upper strata of the earth absorbs from the vegetable matter with which it comes in contact certain principles, usually classed collectively as "organic matter," and, as a rule, rated by chemists as an impurity. After percolating through deeper strata most of this material is filtered out, so that when the spring emerges it is apt to be comparatively free from such matter, except in quantities too small to have a deleterious influence when imbibed. This organic matter is almost always simply a product of vegetable decomposition, and hardly admits of a detailed subdivision. Chemists have, however, succeeded in elaborating from it several secondary products, which may be briefly described as follows:

Crenic and apocrenic acids, known as organic acids, have been detected in some waters. The former is a pale yellow, transparent, hard, uncrystallizable substance. It exists in vegetable mould, and is found in the ochreous deposits occurring in ferruginous waters. Apocrenic acid is derived from humus, a brown powder resulting from the decomposition of wood. It also occurs in chalybeate waters, where it appears as a brownish-colored, amorphous deposit. These acids will be observed in a few analyses as crenates and apocrenates of sodium, potassium, and iron. They possess no known medicinal value, nor, on the other hand, do they appear to be injurious.

Barégine, or *hydrosin*, is a brownish-yellow residue compound of organic azotized matter obtained from certain sulphur waters by evaporating them to dryness. It was first detected in the springs of Baréges, hence its name.

Glairine is an amorphous deposit found in reservoirs where water accumulates. It is insoluble, soft and unctuous to the touch, sometimes transparent, sometimes opaque. It possesses no action, so far as we know.

Sulfuraria is a confervoid growth formed in sulphur waters of which the temperature is below 122° F. In composition it is quite similar to glairin, and leaves a large amount of silicious residue when burned.

In addition to the above-named substances a great variety of microscopic bodies known as algæ are found, though their number is much less in mineral springs than in the waters of ponds, lakes, and streams.[1] Organic matter composed of these growths is not regarded as being harmful; some have even attributed certain medical effects to their presence. The waters of the Red Sulphur Springs of Virgina (q. v.), which contain an unusually large proportion of the algæ, are said to possess a sedative effect on the circulatory system which cannot be attributed to any of the remaining ingredients. These statements, however, by no means apply to the organic matter due to surface contamination, which occasionally finds its way into springs. (See chapter on Potable Waters.)

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[1] Vide Walle. The Fresh-Water Algæ of the United States, 1887.

CHAPTER VII.

THE THERAPEUTICS OF MINERAL WATERS.

The following remarks will embrace an outline of the various conditions in which mineral waters have been found useful by internal administration, an account of thermal waters and balneotherapeutics being reserved for a future chapter.

Impeded or Imperfect Convalescence. Although mineral waters are, as a rule, inapplicable to the acute manifestations of disease, they may serve as useful adjuvants in tardy or delayed recovery from such affections. Let us suppose that a person has suffered from a sharp attack of articular rheumatism. The pyrexia has disappeared, the joint symptoms have measurably subsided, and the patient is able to be up and to walk about, yet he is in a nervous, irritable state; the heart's action is excitable, albeit there may be no valvular trouble; occasional sharp pains, or else a dull, aching sensation may be experienced in the joints or in the adjacent muscular structures. This continues for some weeks in spite of salicylates and alkalies. A change of surroundings is often desirable, and if the circumstances are favorable we cannot do better than refer the patient to a locality where, in addition to pure air and pleasant scenery, he may also have the benefit of a suitable mineral water. Such patients should not be sent far from home, nor to an elevation of more than 1500 feet above the sea-level. A water containing alkaline and saline elements with perhaps a small proportion of iron is best suited for cases of this class. Take again a patient who has suffered in the winter or spring from a severe attack of pneumonia, bronchitis, or "la grippe." The chief symptoms subsided in due time, but a good deal of bronchial irritation remains, with a teasing, irritating cough, especially in the evening. The appetite is not very good, the face is somewhat pale, and it is easy to see that the individual is not up to the normal standard of health. Here also, as the summer season comes on, a change of climate is indicated. The patient may well repair to a high or moderately high mountain resort, and if we are able to refer him to such a locality where a fairly strong chalybeate water may be had, he will be placed under, perhaps, the best possible condition for a speedy restoration to health. In the debility consequent upon almost any acute prostrating disease—malarial or typhoid fever, the exanthemata, peritonitis, a severe and protracted parturition, a bloody surgical operation, or a gunshot or other wound—a few weeks' sojourn at a spa where light carbonated or ferruginous waters may be drunk freely as they flow from the fountain, will do much to aid Dame Nature in restoring strength and vigor.

Anæmia and Chlorotic Anæmia. The ordinary forms of anæmia are characterized by a loss in the total volume of the blood, and may be the result of antecedent or coexisting diseases, poor food, bad surroundings, or a profuse hemorrhage due to hæmoptysis, menorrhagia, a severe wound, etc.

Chlorosis, or chlorotic anæmia, is a disease of early womanhood connected with the development of the menstrual functions. The histological basis of this affection consists not in a loss of the volume of the blood, but of a falling off simply in the number of red blood-corpuscles, or in the hæmoglobin value of the individual cells.[1] No one will dispute the efficacy of the ferruginous preparations in these conditions. Clinical experience has shown the improvement in the patient's health, and instruments of precision have demonstrated conclusively the gradual restoration of hæmoglobin under a properly selected iron preparation. But according to the accumulated evidence of many generations of medical men, anæmic states often yield more readily to an easily assimilable chalybeate water than to any of the pharmaceutical preparations of iron. The arsenical waters are also valuable in conditions characterized by poverty of the blood. Other forms of anæmia, viz., leukæmia, Hodgkin's disease, and the thyroid cachexia, though perhaps not curable affections, are often benefited by the iron and arsenical waters. Amenorrhœa, dysmenorrhœa, and associated disorders of the female pelvic organs are often entirely relieved by these agents.

General Debility. This is a somewhat difficult term to define. It is not a disease, yet it is a symptom of almost all chronic constitutional disorders. Moreover, it frequently exists *per se*, or without any concomitant disease, as far as we can determine. It may be the result of overwork, anxiety, grief, dissipation, etc., and makes itself felt in protean ways. It is the common complaint of hot weather, and probably few human beings escape at least a touch of debility during the summer months. Perhaps the most common marks of its presence are as follows: A disinclination to rise in the morning, indisposition to exertion, loss of interest in the affairs of life, lassitude, stretching, yawning, etc. The stomach is easily upset, the individual is quickly exhausted on exertion; there may be a dull ache in the lumbar region, weak knees, and a played-out feeling generally.

A light alkaline chalybeate water will be found very useful in this condition, and if it can be drunk amid bright and attractive scenery, salubrious air, and cheerful surroundings a speedy recovery may be confidently expected. A morning spray or shower-bath of the water, if well tolerated, followed by a short walk or other light exercise in the open air, will be found a valuable adjunct to the treatment.

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[1] Vide articles by the author—New York Medical Journal, June 10, 1887, and the American Journal of the Medical Sciences, February 18, 1893.

Dyspepsia and Diseases of the Alimentary Tract and Liver. It is not an exaggeration to say that at least nineteen out of every twenty mineral spring waters now in use in the United States are recommended as being useful or curative in dyspepsia. Without admitting the ofttimes extravagant claims of proprietors or others in interest, it must be admitted that a very large class of patients suffering from enfeebled digestion are materially benefited by the rational use of a proper mineral water. The waters *par excellence* for ordinary gastric dyspepsia presenting the symptoms of acid eructations, pyrosis, fulness after meals, etc., are those plentifully impregnated with carbonic acid and the alkaline carbonates. The carbonates of sodium and magnesium are especially valuable. If there is a tendency to diarrhœa the carbonate of lime is of great utility. These waters are generally best taken during or soon after meals. Though not so palatable they act more efficaciously when drunk warm in small and frequent doses. In atonic states characterized by peristaltic inertia and deficient secretion of gastric juice, waters rich in the chloride of sodium and carbonic acid are needful. These may be taken before meals, and cold, so as to retard stomach absorption and emphasize the local stimulating effect. In many dyspeptics the foregoing conditions are very liable to coexist, and happily we are abundantly supplied with mineral waters in which the chemical ingredients are adapted to the various associated symptoms.

In gastric ulcer the carbonated alkaline group of waters is also serviceable, but it is important not to imbibe too great a quantity of the gas, as a tendency to hæmatemesis may result from the temporary stimulation of its contact with the gastric walls. It should be borne in mind that no form of internal medication, either by mineral waters or by drugs, will prove permanently useful without a proper regulation of the diet. A few useful hints are as follows: Allow ample time for meals and masticate the solid portions of food thoroughly. Avoid fat meats and rich or greasy dishes generally. Eat sparingly of sweets. The average pie and cake may be wisely omitted from the dietary.

Constipation. This disagreeable condition may exist with or without gastric dyspepsia, and is seldom a primary affection, being usually dependent upon a variety of other derangements. The determining factors are usually a deficiency of the normal intestinal secretion or a loss of peristaltic power of the intestinal muscular coats. In obstinate states of this kind a course of mineral waters is frequently a valuable adjunct to the treatment, and, with proper dietary rules, will usually prove successful in obtaining relief. One of the sulphated saline or bitter waters, containing the sulphate of soda or magnesia or both of these salts, is applicable to these cases. The presence of a certain amount of the chloride of sodium and the alkaline carbonates held in solution by carbonic-acid gas lends additional efficacy to the water.

Fortunately, we have many such waters in the United States, and the springs from which they flow are within easy reach of almost all sections of the country. They need not necessarily be highly mineralized. It is surprising how slight a proportion of saline ingredients will serve to give a natural water aperient properties. Such waters are usually best taken early in the morning before food, the quantity to be regulated in accordance with the strength of the water, the weight of the patient, and the obstinacy of the constipation. A brisk walk or other form of exercise after taking will expedite the action of the water. One, two, or even three, painless, watery evacuations of the bowels usually occur soon after breakfast. If further action be desirable, a somewhat smaller quantity may be taken before each of the two following meals.

Abdominal Venosity or the "Full Habit." This condition, termed by the old German writers abdominal plethora, and variously known as abdominal stasis, portal obstruction, the hemorrhoidal diathesis, etc., is usually dependent upon an engorged liver. This in turn is apt to be due to a continued excess in eating and to undue indulgence in malt liquors, combined with a sedentary life. It is a frequent accompaniment of organic cardiac disease, especially when involving the right side of the heart, and is also met with in connection with emphysema of the lungs. The liver in this condition is somewhat enlarged, its lower border being rounded in outline and projecting for some distance below the ribs into the abdominal cavity. More or less catarrh of the bile-ducts is usually present. The portal vein and its tributaries are full and the circulation sluggish. The patient will probably be troubled with piles. The complexion is earthy or dusky, the conjunctiva tinged with yellow, the tongue coated, and the bowels usually constipated. Drowsiness in the afternoon is a common feature, and the patient may complain of fulness in the head after eating, with dizziness and vertigo at times. The condition is often associated with corpulency, and fatty infiltration of the heart and liver may be present.

Hygienic and dietetic regulations, with the various forms of active and passive exercise, are of prime importance in this condition, and they are often greatly assisted by the pharmaceutical preparations; but there will be found a considerable proportion of obstinate cases in which mineral waters are of the utmost service and must, indeed, supersede other methods of treatment. Those proving most useful under these circumstances are the bitter waters containing the alkaline sulphates and the chloride of sodium and saline sulphureted waters. These probably act by stimulating the process of endosmosis and exosmosis. They promote the liquefaction of the bile, increasing its flow, stimulate the intestinal secretions, and improve the peristaltic action of the muscular coats of the bowels, thus expediting the escape of effete products from the system. As in simple constipation, mineral waters for this condition are best taken while the stomach is empty, and preferably before the first morning meal. A considerable period of rest in a salubrious atmosphere, with quiet and peaceful surroundings, and a careful diet should follow all courses of the stronger purgative waters.

In jaundice due to the presence of gallstones the alkaline sulphated and muriated saline waters serve a useful purpose. We do not know whether the efficacy of these waters depends solely upon the formation of a thin liquid bile, by which gallstones are readily washed downward, or whether the bile is rendered so strongly alkaline as to effect a solution of the components of the stone; but, as an old writer (Niemeyer) has justly remarked, "We should not delay prescribing this treatment till the mode of its action be explained." By their detergent effects these waters also act well in icterus due to catarrh of the bile-ducts and to chronic congestion of the liver.

In fatty, waxy, cancerous, or cirrhotic disease the administration of mineral waters is as futile as other forms of medication; but a moderately strong alkaline-saline water may be found of service in the symptomatic gastric and intestinal disturbances which are liable to be present. In the early period of ascites, whether due to cirrhosis of the liver or to cardiac or renal disease, we may gain a useful derivative effect by the employment of one of the stronger sulphated saline waters in carefully gauged doses.

Diarrhœa and Dysentery. In some parts of the United States, notably in Virginia, practitioners have long been in the habit of prescribing alum waters for obstinate cases of summer diarrhœa and for dysentery of long standing. Some of the ferruginous and acid waters have also found favor in these affections. It is probable, however, that the stronger calcic waters are more generally useful than others in conditions marked by looseness of the bowels. A sojourn at one of the calcic spring resorts has often proved successful in refractory cases where other medication had failed.

Rheumatism. This affection figures largely in most spring circulars, and there are few mineral waters in the United States which have not been recommended for it, either internally or by means of baths. This universal commendation, while no doubt overdrawn in some instances, is not without foundation. An obstinate case of chronic rheumatism may well be given a trial with some form of mineral water. Disregarding for the present the use of baths, there are several rheumatic conditions to which the internal use of mineral waters is applicable. We have already referred to convalescence from acute articular forms of the disease. In chronic articular or muscular rheumatism one of the alkaline carbonated or lithic waters may be taken daily as a matter of habit. In the condition known as rheumatoid arthritis or rheumatic gout, characterized by painful nodular swellings, especially of the joints of the fingers, one of the lithiated alkaline waters may also be used habitually. They may be taken at home as well as at the springs, but the conjunction of thermal mud or peat baths greatly promotes their efficacy. A water containing a small proportion of iron and arsenic is also valuable in these conditions. Obstinate cases of lumbago, scapulodynia, pleurodynia, etc., are benefited by the same class of waters.

Gout and the Uric-acid Diathesis. A number of diseased conditions of which gout is, perhaps, the most prominent example, are believed to originate from an excessive formation of uric acid in the system or to its non-elimination from the blood. This in turn is due primarily to defective digestion and faulty assimilation, with consequent derangement of the nutrient processes. In accordance with the most recent, but still somewhat obscure, researches of biological chemistry, the excess of acid is liable, under certain circumstances, to crystallize in the tissues, thus giving rise to the painful swelling of the joints, especially of the greater tarso-metatarsal articulations, which we observe in the initial stage of acute articular gout. In this early period mineral waters are useless. After the subsidence of the attacks, the uric-acid tendency having been recognized, some of our mineral waters possess a potent influence in correcting the abnormal state of the blood, which is liable at any moment to renew the acute mischief. Two classes of waters will now be found useful: First, the alkaline waters. It is well known that when alkalies are brought into contact with uric acid, alkaline urates, soda, lithia, magnesia, lime, etc., are the results. These salts being to a great extent soluble their easy expulsion from the system is favored. It is at the same time desirable to stimulate the emunctories, and this we can readily do, either by one of the pharmaceutical formulas, or by one of the alkaline, sulphated, or bitter waters. It is not unusual to find the water of a single spring possessing all the elements desired for this double purpose of dissolving the uric acid and of eliminating it from the system.

Dr. Irwin[1] very properly emphasizes the fact that the introduction of a large quantity of alkaline salts into a system hypercharged with uric acid, without at the same time making provision for the speedy solution and removal of the resulting urates, renders an acute attack of gout very likely. "This is the explanation of those unfortunate crises which occasionally occur during an apparently well-directed course of alkaline medication, and which are responsible for the impression not uncommon among podagric wiseacres that 'it is better to leave the gout severely alone.'" A moderately strong sodic or lithic alkaline water may be taken for a long period without giving rise to the alkaline dyscrasia, and with a continuance of its good effects in eliminating the *materies morbi* of the disease. The iodo-bromated and sulphureted waters are also highly esteemed by some observers in the treatment of gout.

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[1] Op. cit.

Uric-acid Gravel and Calculi. In this connection it seems proper to refer to another of the prominent and troublesome conditions due to a defective elimination of the organic nitrogenized substances from the system. Gravel and stones are usually formed in the kidney, whence they are washed into the bladder, from which they are speedily discharged with the urine, or else remain and, by constant accretion, continue to increase in size. But whether found in the kidney or in the bladder, they are due to the same constitutional vice, and are in no wise dependent upon diseases of the urinary organs. They frequently, however, give rise to severe local manifestations in the kidney, ureter, or bladder, and may even lead to inflammation and suppuration. A calculus may be described simply as an overgrown gravel-stone, being due to the same causes and composed of the same elements. They may be divided into the uric-acid calculi—probably two-thirds of the entire number—and oxalic acid, which may be termed acid gravel, and phosphatic or alkaline gravel. Occasionally all these elements are found in a single stone. The larger forms of calculi sometimes contain xanthine, cystine, indigo, etc. Calculi vary in size from a pinhead or a pea to eight or nine ounces, or even a pound or more. Sometimes the material of gravel or stone escapes in the form of sand and gives rise to no inconvenience. The chemical constitution of gravel or stone may often be learned from a microscopical examination of the urinary deposits. In the red, or uric-acid gravel, the alkaline waters are of undoubted utility. Their good effects are produced in several ways: 1. They aid in the correction of the constitutional vice which gives rise to the production of the concretions. 2. By their diuretic and diluent action they palliate the local symptoms of catarrh and inflammation. 3. They are believed by many to aid in the breaking down and chemical disintegration and solution of the calculi, thus favoring their speedy expulsion with the urine. The widely advertised lithia waters, to which physicians' attention is so frequently called by enterprising spring owners, are credited with this power. It must be confessed that several of them adduce some very respectable medical evidence to sustain their claims. Calcic waters also act well in uric-acid gravel and calculi, and are the chief reliance in phosphatic gravel. It is difficult to explain their action beyond the empirical statement that when given in this condition they seem to promote the expulsion of the offending bodies. H. Weber[1] is of the opinion that this influence is due to their administration in large quantities, so as to produce a washing-out effect, which, he thinks, could be as well brought about by the systematic drinking of large quantities of hot water on an empty stomach. Authorities agree that in calculous diseases mineral waters should be taken freely—four, six, eight, or ten glasses daily—and continued for a considerable period of time. It has been cautioned that the urine should not be allowed to become too alkaline, as this might lead to a deposition of phosphates around a small uric-acid stone. There seems to be no good reason to believe that this condition has ever been brought about by the use of mineral waters.

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[1] Op. cit.

CHAPTER VIII.

THE THERAPEUTICS OF MINERAL WATERS.—(*Continued.*)

Chronic Cystitis, Vesical Catarrh, Enlarged Prostate, Gleet, etc. All of these conditions are more or less benefited by a liberal allowance of one of the milder alkaline-saline waters. They allay urinary irritation by their diuretic influence and by maintaining the urine in an alkaline state. In the debilitated state accompanying chronic cystitis an alkaline-saline chalybeate water may be selected.

Other Lithæmic or Uric-acid States. Various additional disorders of the digestive, nervous, cutaneous, and circulatory systems are believed to be in some way connected with nutritive disturbances resulting from the imperfect evolution of urea. Admitting the *rationale* of the action of the sulphated waters as previously presented, it is but just to grant their efficiency in these allied states. Some of them will be referred to in separate paragraphs.

Diseases of the Skin. A large number of our mineral waters are recommended as being useful in skin diseases, some of them without evident reason. However, admitting or not their relationship to the uric-acid diathesis, it seems to be well established that in the chronic stages of the common scaly cutaneous affections—eczema, psoriasis, and pityriasis—the alkaline waters are notably beneficial. They also produce good effects in acne. Their action is slow, however, and it requires a considerably prolonged course of the waters, combined with careful hygienic and dietetic regulations, to produce a noteworthy effect. The arsenical waters also possess high claims for utility in these disorders. Some of our American waters contain sufficient quantities of this powerful drug to produce its well-known physiological effects after a few days' use. The saline sulphureted waters, both internally and in the form of baths, are also applicable to the affections, but should not be used during their acute exacerbations.

Diabetes Mellitus, or Persistent Glycosuria. Without pausing to consider the various problems involved in the causation and pathology of this affection, and the exact identity of glycosuria with saccharine diabetes, it may be stated that the therapeutic value of mineral waters in causing the arrest of sugar formation and its disappearance from the urine has been altogether overrated, not only by those interested in the waters, but by careful and unbiased clinical observers as well. A few years ago it was quite commonly believed that we had in some of these agents remedies by means of which we could successfully cope with this formidable and mysterious affection. Continued experience, however, has taught us the fallacy of these expectations. It is undoubtedly true that in the milder forms of glycosuria a course of treatment at some one of our spring resorts may result in an improvement of the general health and in a diminution or temporary removal of sugar from the urine. But this may, to a great extent, be attributed to the watchful dietary regulations in vogue at such places and to the temporary change of environment and escape from the worries and anxieties of home.

The alkaline and calcic waters have enjoyed the largest share of celebrity in the treatment of diabetes. "Under their use the diabetic gains in strength, the harassing thirst ceases, the skin becomes moist, the urine is reduced to almost normal specific gravity, and often every trace of sugar disappears."[1] We are informed by Althaus[2] that in some instances the disease has been brought to a stand-still for years by the use of the Vichy waters. In the frequent cases of chronic glycosuria occurring in corpulent and gouty persons, preference should be given to the alkaline and sulphated saline waters. It has seemed to the author that the light arsenical waters of Virginia are best adapted to the milder cases of glycosuria. Whatever benefit we may attach to the use of mineral waters, however, cannot in justice be referred to any specific influence, but to the resulting improvement in digestion and assimilation.

Syphilis. This disease and some of its sequelæ are, no doubt, much benefited by a systematic course of sulphureted and thermal baths, and to these we shall refer in the proper place. It is to be doubted, however, whether we can do more than render a very moderate assistance to the artificial preparations by the internal administration of mineral waters. Much has been claimed for the iodo-bromated waters in the treatment of this disease, but the proportions of iodine and bromine are so small in these waters as to arouse a feeling of skepticism as to their value. We are, however, undoubtedly able to do much to overcome the debility and tendency to cachexia often observed in this disease by a carefully selected water. The light alkaline chalybeate class are valuable for this purpose, and the addition of saline elements is usually desirable; but no course of mineral-water treatment should in any case replace or supersede the well-defined methods of drug treatment which have so long been in vogue, and the efficacy of which is unquestionable.

Scrofula, or the Strumous Diathesis. We do not hear so much of scrofula or struma as of yore. The general tendency of medical opinion during the past fifteen or twenty years has been to narrow and limit the significance of the term, and even to restrict it to those slow and indolent inflammations and overgrowths of lymphatic tissue which end in caseation and eventually imperfect suppuration. Formerly almost every deviation from healthy functional activity in the young, as well as every disorder of nutrition which could not be assigned to any definite cause, was called struma.[1] A study of many of the mineral spring circulars which fall into the hands of the medical practitioner would lead to the impression that this ancient comprehensiveness of the term is still in vogue in some quarters. "Scrofula embraces almost everything, and the water of the spring herein described affords the best known remedy for scrofula." Yet there is a considerable class of cases characterized by nutritive disorders of the skin, joints, bones, etc., and especially of the lymphatic glands, which are properly embraced under the term scrofula or struma. These cases are readily identified by the observant practitioner and require no description here. Aside from the many local manifestations of scrofula which usually require surgical aid we can, in various ways, oppose the diathesis by hygienic and dietetic measures, and by internal medication. The use of certain mineral waters, both internally and by means of baths, properly enters into the last-mentioned method. The testimony of trustworthy medical men for many years past attests the value of the alkaline carbonated and chloride of sodium waters in scrofulous conditions. The iodine and bromine waters have also occupied a high place in this connection, but owing to their extreme tenuity we must accept statements regarding their efficacy with reservation. It cannot be gainsaid, however, that the chalybeate and arsenical waters are valuable in some cases, chiefly, no doubt, on account of their good influence on nutrition.

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[1] Walton. Mineral Springs of the United States and Canada, p. 145.
[2] Althaus. The Spas of Europe, p. 320.

Renal Diseases. It would be difficult to find an advertisement of a mineral water which does not include diseases of the kidneys among the troubles cured or greatly benefited by its use. Simple, pure water is a mild and harmless diuretic, and no doubt often beneficial in renal affections. The same may be said of the water of many mineral springs, but it is difficult to learn from a study of the analyses upon what grounds the wonderful claims made in numerous instances are based. Surely no rational medical practitioner can bring himself to believe that the mineral ingredients of an alleged mineral water containing two or three grains of solid contents to the gallon can possess a very potent influence in restoring an advanced case of Bright's disease. Genuine mineral waters of the proper class do, however, exert a favorable influence in certain conditions when nephritis is present. When the urine is scanty and high-colored or when it is acid in reaction, one of the alkaline or calcic waters may be administered in considerable quantities with undoubted advantage and with entire safety. As some of these waters have sufficient mineral ingredients to make them active renal stimulants, the same discrimination must be exercised in their exhibition as in the case of the artificial diuretics. It has not been shown that any form of mineral water possesses the power directly to lessen the amount of albumin in the urine. The use of these waters in the treatment of uric acid and phosphatic sand, gravel, etc., has already been considered.

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[1] Lynch. Pepper's System of Medicine, vol. ii. p. 231.

Diseases of the Nervous System. The internal use of mineral waters is not to be relied upon in the treatment of the organic affections involving the brain or cerebro-spinal system of nerves. They may, however, be properly employed in a number of functional disturbances, viz., headache, neuralgia, neurasthenia, hypochondriasis, etc. Most of these phenomena being merely symptomatic, their rational treatment depends upon the associated conditions to which they owe their origin. Insomnia, headache, and hypochondriasis, for example, may be due to business worry, anxiety, or overwork, which a few weeks' absence from home, amid the leafy recesses of some quiet rural resort, whether a spa or not, will speedily remove. It is to the cause of these nervous manifestations that we must direct our attention. If an habitual sick headache is due to dyspepsia, constipation, or biliousness, we may prevent its appearance by means of the alkaline, carbonated or sulphated saline waters, as the case may be. If neuralgia is produced by anæmia, or cardiac palpitation by chlorosis, a chalybeate water may be selected. It is possible that the borated waters may be found useful in epilepsy and chorea; but experience as to their utility is lacking.

Diseases of the Respiratory Organs. Mineral waters have attained to very little prominence in the therapeutics of respiratory affections, yet they may find a useful application in some of the chronic conditions affecting the bronchial tubes and lungs. No one would be inclined to question, for example, the utility of a palatable and easily assimilated chalybeate water in the early stages of phthisis, though, of course, this should not be relied upon to the exclusion of more positive forms of treatment. It is well known that such cases often do exceedingly well at some of our spas. Nor are the good results always fairly attributable to the climate and environment of such resorts.

Acid and alum waters have been recommended with some show of reason for night-sweats and hæmoptysis. The alkaline muriated waters show a very favorable influence in the treatment of chronic laryngitis and clergyman's sore-throat. They should be taken warm in these affections, and slowly sipped. In chronic bronchitis with profuse expectoration, the alkaline and muriated alkaline waters, as well as some of the sulphur waters, have been f[illegible]al. Relief is also sometimes obtained in asthma with s[illegible]tis by the same means. In the purely spasmodic form [illegible]se, without bronchitis, such waters are of no value [illegible]lts have, however, been reported from the liberal use [illegible]cal waters in asthma. Iron and arsenical waters ha[illegible]ed beneficial in pulmonary emphysema, no doubt by their favorable tonic and reconstructive influence and not by any specific action. There can be no doubt that the pure air and cheerful environment of many of our spring resorts exercise a most favorable influence in the tardy convalescence and imperfect resolution sometimes observed in pneumonia. Muriated saline, alkaline, chalybeate, and sulphureted waters are preferable here.

Diseases of the Heart. It is quite the fashion to declaim against the use of mineral waters in organic diseases of the heart or great vessels. This may be very proper when referring to thermal baths, but carefully regulated quantities of some one of these waters may often serve a useful purpose. In cases of general anasarca, threatening an overflow of the lungs (pulmonary œdema), a properly gauged dose of one of the bitter waters will render as useful a service by its detergent effect as a dose of pharmaceutically prepared sulphate of magnesia or Rochelle salts. Likewise, in valvular lesions characterized by hepatic congestion and general fulness of the veins, we may gain a good result by an occasional exhibition of one of the same class of waters. In the stomachic catarrh of mitral lesions the mild alkaline saline class of waters may be administered with entire safety, and often with good results. In the functional cardiac disturbances resulting from anæmia and chlorosis, hyperacidity of the stomach, excessive smoking, etc., a light alkaline carbonated chalybeate water is indicated. The Schott-Nauheim treatment of chronic cardiac disease will be noticed in the section on Baths.

Chronic Malarial Toxæmia and the Paludal Cachexia. In certain sections of the country, notably in Virginia, some of the stronger sulphureted chalybeate waters are credited with a specific influence in these conditions. The arsenical waters are believed, especially on the Pacific Coast, to possess a positive action in eradicating malaria from the system after quinine has failed. We may more readily believe, however, that the good results which are often observed as a result of their use are due to the tonic and restorative action of the waters and to the favorable circumstances of climate, scenery, etc., under which they are usually drunk. The iodic waters are esteemed as possessing the power of reducing splenic enlargement and removing other evidences of the paludal or malarial cachexia.

Obesity. A tendency to corpulency, whether or not attended by abdominal venosity (q. v.), is benefited by a morning draught of one of the saline sulphated waters. By promoting eliminative metabolism a liberal course of the alkaline-saline waters also retards adiposity. The use of thermal baths, however, is a more reliable method of overcoming this disagreeable condition. But no other plan of treatment should be allowed to supersede a carefully abstemious diet—excluding sugar, carbohydrates, etc.—and proper exercise.

Uterine Disorders. It is quite common for gynecologists in Europe to refer some of their more obstinate cases of uterine trouble to one of the spas for a course of mineral waters or baths. Those best adapted for such treatment are chronic congestion of the womb, obstinate cases of perimetritis, and fibroid tumors. The muriated salines for internal use, and the thermal sulphureted waters for bathing and for the douche, have been found most useful for these cases.[1] The magnesium waters are of benefit in engorgement of the pelvic viscera accompanied by chronic metritis. Chronic corporeal and cervical catarrh and leucorrhœa are often much improved by the alkaline chalybeates and mild sulphureted waters. The stronger alum waters, in the form of the ascending douche, also afford relief in these conditions as well as in some cases of cervical ulceration. The lighter sulphated saline waters may be safely used in the constipation of pregnancy, as they have no tendency to produce uterine contractions. The use of mineral waters in menstrual disorders has already been considered. (*Vide* Anæmia and Chlorosis.)

In the constipation of children, Perier and others of the French school employ the mild saline waters. They are also used to counteract the acid stomach of dentition. The light alkaline carbonated chalybeates may also be used with advantage in enlarged cervical glands, tabes mesenterica, etc.

Chronic Metallic Poisoning. Several varieties of mineral spring water have been recommended as being useful in overcoming the effects of chronic metallic poisoning and in expelling the offending substances from the system. In chronic lead-poisoning the sulphuric acid waters are valuable, forming inert and insoluble sulphates of lead, which are eliminated in this form by the emunctóries. Sulphureted and sulphated saline waters are also prescribed for the same purpose, as well as for copper-poisoning and mercurial poisoning. The bromine waters are somewhat dubiously recommended for lead-poisoning and also mercurial poisoning, as forming soluble compounds with the metals, which are thereby readily expelled.[2]

[1] H. Weber. Op. cit.

[2] Winslow Anderson. Mineral Springs of California, 1892, p. 28.

CHAPTER IX.

BATHS AND DOUCHES AND THEIR MEDICINAL USES.

The ordinary cold-water bath ranges in temperature from 40° to 60° F.; the temperate bath from 60° to 85° F.; the tepid bath from 85° to 92° F., the warm bath from 92° to 98° F., and the hot bath from 98° to 106° F., or a little higher. The warm and hot baths are most frequently employed for medicinal purposes.

In his quest for new therapeutic aids, the inventive genius of man has devised numerous modifications of the simple water bath, some of which appear to us at this day as queer and fantastic. Thus, animal baths, made of blood, milk, bouillon, oils, or fats, have been in vogue, and at one time it was customary to envelop the sufferer's naked body in the freshly removed skin of a calf, sheep, wolf, or dog. Vegetable medicated baths were composed of wine, vinegar, solutions of essential oils, infusions of thyme, rosemary, wormwood, lavender, willow, oak, Peruvian bark, etc. Medicated vapor baths contained incense, myrrh, benzoin, amber, sulphur, calomel, etc., and some of these are employed in a limited degree at the present day.

We no longer use animal excrement for bathing purposes, but baths of mud or moor and peat are still retained. It is beyond the province of this work to enter into a detailed description of the various methods of applying water to the cure of disease. We will, therefore, content ourselves with a cursory review of the principal forms of baths and douches in use at the present day, referring the reader to special works on hydrotherapeutics for more minute information.

The first purpose of the bath is that of abstersion or cleanliness —that is, to remove any foreign impurity from the surface and to prevent the pores from being clogged by their own secretions and by the desquamation of the cuticle. We cannot place the same credence in the absorptive power of the skin once accorded to that important organ. The skin undoubtedly absorbs gases to a certain extent, and it is possible that a strong salt solution may be partially absorbed at a favorable temperature—92° to 97° F. It is proper to say, however, that under the ordinary circumstances of the bath the weight of modern testimony opposes the view that there is any appreciable interchange of fluids between the blood and the bath medium. In the case of medicated or mineral baths, therefore, any modification of the effects of the simple bath may be attributed in a great degree, if not altogether, to the local influence of the artificial or natural ingredients of the water upon the cutaneous investment of the body. It is well known, however, that the human system tolerates changes of temperature in the air to a much greater extent than in water. While the air at 75° is perhaps too warm for most persons, a continued bath at that temperature becomes cold and depressing. Again, a bath at 98° to 102° acts far more energetically than the atmosphere at the same temperature. This is due to the fact that water, being a better conductor than air, brings more heat to the body, and at the same time suppresses cutaneous exhalation, which, as we know, is greatly increased by the air at that temperature.

The Cold Bath. This is the ordinary natural bath which we take in streams, lakes, spring reservoirs, or the surf. While usually ranging in temperature from 40° to 60°, a hardy person can stand an even lower temperature. It may be stated that a lower degree than 50° F. is always dangerous if long continued.

PHYSIOLOGICAL ACTION. The primary effect of the cold bath is shown in a contraction of the peripheral bloodvessels, an acceleration of the pulse and respirations, an increase in the secretion of the urine, and in the general promotion of tissue metamorphosis. There is an increase in the external expenditure and the internal production of heat, the blood at first probably rising 3° or 4° in temperature. Very soon, however, the period of reaction sets in, when we have an opposite set of phenomena developed. The skin is reddened from expansion of its superficial capillaries, the pulse is diminished in frequency, and the temperature is reduced to a point, perhaps a degree or two, below the normal. If properly employed under favorable conditions, the effect of the cold bath is exhilarating and unquestionably beneficial. When reaction sets in the skin is dry, a warm, grateful glow suffuses the surface, the muscles act with ease and elasticity, the mental faculties are clear, and a decided sense of well-being pervades the system. The individual feels capable of increased exertion, mental as well as physical. The physiological action of the cold bath may thus briefly be described as gently stimulating and decidedly tonic. It augments the appetite, promotes the functions of the skin, kidneys, and liver, and, by the increased elimination of carbonic acid and the effete products of tissue combustion, improves the quality of the blood. When the bath has been too much prolonged, the water too cold, or the bather in an improper condition, reaction may be very difficult to establish, and disagreeable or even alarming symptoms ensue. The skin is pale or mottled, and corrugated, the extremities cold, the breathing labored, perhaps gasping, the lips chatter, and speech is difficult. If not relieved the nose and lips become cyanotic, painful cramps seize the muscles, a sense of suffocation or constriction is felt in the epigastrium, and the patient is liable to pass into unconsciousness and death. It is fair to state, however, that such inopportune results from the cold bath are seldom met with, nor are the ordinary colds of every-day life liable to follow.

There are certain contraindications to the use of the cold bath which it is well to observe. In feeble or debilitated persons, or in diseases of the internal organs, where the system is incapable of a rapid and effective response, great care is required. Cold baths are contraindicated in almost every form of organic disease, especially of the bloodvessels, heart, kidneys, liver, or spleen.[1] Old persons, in whom the arteries are liable to be fragile, should avoid such baths. It is eminently proper that every person beginning a course of cold baths be examined by a competent physician.

The best time for the hygienic cold bath is early in the morning, when the stomach is empty. It should not be of longer duration under ordinary circumstances than four or five minutes, and its effects may often be obtained in fifteen or twenty seconds. It is better not to lie in the water longer than ten seconds at a time. At the expiration of that period the patients should stand upright in the tub and rub the body vigorously with the hands. A few seconds under the shower-bath often answer the purpose of the cold bath, especially in cold weather. A momentary cold affusion to the skin after the ordinary warm bath will relieve the feeling of weariness and lassitude which sometimes follows the latter bath.

THERAPEUTICS OF THE COLD BATH. This bath is employed rather to maintain the health and hardiness of those already well than to heal the sick. It cannot be gainsaid that a quick cold bath, followed by a vigorous rubbing of the skin and a good reaction, affords a prophylactic influence against "catching cold" and all that the ill-used phrase means. Yet there are not a few diseased and disordered states of the system in which the judicious use of the cold bath may serve as a valuable auxiliary to other modes of treatment.

We cannot here undertake an elaborate account of the various hydriatric uses of cold water. Its introduction as a therapeutic agent in typhoid fever by Ernest Brand in 1861 and its subsequent wide adoption for this purpose as well as for other conditions marked by a high temperature are well known. At this late day no observant practitioner of medicine who has thus employed the cold bath will deny its superlative merits over other methods of reducing the temperature, and the method requires no further words of defence or apology. The graduated bath, the cold pack, cold affusions, spongings, and compresses and frictions with ice, all act in the same manner as the cold bath, and depend for their efficacy upon their influence in abstracting heat from the body, and are useful in accordance with their ability to accomplish this purpose. Cold baths, however, are seldom used for their antifebrile effects at spring resorts. The following remarks, therefore, will apply more especially to their employment in chronic diseases, to which alone spa treatment is, as a rule, applicable.

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[1] This does not refer to the cool or temperate baths.

Habitual constipation from atony of the muscular coats of the bowels, with a tendency to hemorrhoids and abdominal plethora, is sometimes materially benefited by the systematic use of cold baths. Chronic dyspepsia and catarrh of the stomach may be favorably influenced by the same means. Muscular pains and rheumatism may also be improved by this method, though, as a rule, warm and hot baths are preferred. In allaying the local irritation of urticaria, scabies, prickly heat, and other irritative skin troubles general cold baths may be highly grateful. It is even stated that psoriasis may be cured by their prolonged use. In anæmic states general cold applications have caused an apparent increase of the red blood-globules and hæmoglòbin. They are also of undoubted utility in cases of neurasthenia. Rickety, scrofulous, and ill-nourished children often revive speedily under the systematic use of carefully applied cold baths. Salt or sea-water is preferable for the bath in these cases. Even in phthisis a moderate use of the cold bath of a few seconds' duration often proves beneficial. The cold hip or sitz-bath may prove beneficial in certain catamenial irregularities. Profuse menstruation may be checked by a cold hip-bath of three to five minutes' duration, but its application for this purpose should be undertaken only under the advice of a physician. Hysterical attacks may be prevented by systematic hip-baths, and some authors believe that diabetes insipidus may be arrested in the same way. Spermatorrhœa and nocturnal seminal emissions are often benefited by a cold hip-bath at bedtime. Dysmenorrhœa, ovarian neuralgia, nymphomania, and other disorders of the female pelvic organs characterized by pain or nervous excitability may be treated with advantage by this bath. The various partial baths—viz., the foot-bath, the arm-bath, etc.—do not call for description here.

The Temperate and the Tepid Bath. The temperate bath (60° to 85° F.) and the tepid bath (85° to 92° F.) are usually chosen for purposes of ordinary ablution. They abstract heat from the body and lower the pulse-rate in the same way that cold baths do. They entail little, if any, shock to the system, however, and can be borne for a much longer period than the cold bath. These baths are useful, though in a lesser degree than the cold baths, in febrile states. They may be employed in feeble persons of low vitality where a colder bath would not be well borne. According to Baruch,[1] a lukewarm bath, 70° to 80° F., or beginning with 90° F. and gradually cooling, is valuable as a pelvic antipyretic, and may be employed with friction in utero-vaginal affections when not connected with pus formation. Prof. Leyden[2] recommends baths of five to twenty minutes' duration at 86° to 95° F. in locomotor ataxia. He states that they cause a general improvement and invigoration of the system and a calming of the pain. Though no cures are observed, the beneficial effects of the baths cannot be questioned.

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[1] The Principles and Practice of Hydrotherapy, 1898.
[2] Real Encyclopädia, Band xix.

The Warm Bath. (92° to 98° F.) PHYSIOLOGICAL ACTION. This is the bath of luxury *par excellence*, and is the one usually chosen by the timid, especially of the gentler sex. At most of the American thermal spas where the water issues from the ground at a high temperature the plunge baths and swimming pools are cooled down to a degree bringing them well within the classification of the warm baths. Under the influence of this bath a sense of calm enjoyment and tranquillity ensues. The respirations are diminished in frequency, the pulse-rate is lowered, and if the temperature of the water be less than 95° or 96° F. the heat of the body is invariably diminished. The soothing, hypnotic influence of the warm bath is doubtless due to a contraction of the cerebral vessels, producing a temporary anæmia of the brain; but Heyermann and Krebs[1] appear to have shown that water at this temperature possesses a direct local effect upon the peripheral cutaneous nerve-endings. The warm bath is undoubtedly the most favorable for the absorption of mineral substances, and exhalation from the skin is also increased by this temperature. This bath may be prolonged with safety for a much greater period than either the cold or the hot bath, but its undue continuance daily for weeks in succession gives rise to an eruption termed by the French *la poussée*, and by the Germans the *bad-sturm*, or bath fever. The appearance of these symptoms is a warning that the bath is being overdone, and calls for a diminution in its frequency and duration.

The ultimate physiological effect of a properly conducted warm bath may be described, then, as sedative, restorative, and mildly antipyretic. These results are practically the same as those derived from the cold bath, the difference resting chiefly in the manner of producing them—the cold bath being attended by shock and reaction, the warm bath being devoid of these processes.

THERAPEUTICS OF THE WARM BATH. While extensively resorted to for purposes of ablution and as a pastime, the warm bath does not possess so positive a therapeutic influence as the hot bath. Yet it may be found a valuable auxiliary in a number of diseased conditions. Aside from its sedative and mildly antipyretic influence in scarlet fever, infantile pneumonia, and other acute febrile diseases, it is recommended in a considerable range of chronic complaints, and is used at many spring resorts. It is believed by some observers that the general reddening of the superficies produced by a warm bath has a derivative influence upon the deeper structures, and may thus tend to relieve visceral congestion. The fact of the development of a transient cerebral anæmia appears to have been well established, and some go so far as to maintain that a temporary cessation of the bile formation may result from the withdrawal of blood from the liver. The warm bath is thus recommended in icterus, with the belief that the accumulated bile elements might be eliminated by the kidneys and skin. Various forms of hepatic hyperæmia may be benefited by this means.

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[1] Virchow's Archiv, Band i. Heft 1.

F. A. Hoffmann, of Leipsic, advocates its use in congestive states of the kidneys, although the hot bath is generally preferable in renal disease. A warm bath of short duration is safely borne in most cases of even advanced cardiac disease, and there is good reason for believing that the general dilatation of the superficial capillaries relieves the organ of some of its labor. The patient should dress in an adjoining room where the air is free from moisture, and should avoid too active friction with towels. A rest of fifteen to thirty minutes in the reclining position should follow the use of the bath. The warm bath is highly recommended by Hoffmann in the anæmia complicating obesity as the most efficient remedy for withdrawing water from the system. The warm bath is of utility in subacute and chronic rheumatism, and in the form of the sitz-bath in painful bladder and uterine disorders, though in a less degree than a bath of higher temperature. As the warm and the hot bath merge into each other, and are often used in similar conditions, further discussion of the subject will be continued in the next paragraph.

The Hot Bath. (Temperature 98° to 106° F.) The heat of the hot bath may be regulated to some extent by the susceptibilities of the individual. Some persons shrink in dismay from a temperature of 100° F., while others tolerate without inconvenience a degree of 106° F., or even higher.

Physiological Action. This is entirely different from that produced by warm water. Its effects are rather of an excitant than a sedative character. The body-temperature is augmented, the pulse and respirations are increased in frequency, and the skin is reddened and congested. Exhalation from the surface and diaphoresis are markedly promoted, while absorption by the skin occurs to a very slight, if any, degree. It is probable that cutaneous absorption ceases altogether in water above 97° F. The secondary effects of the hot bath are liable to be of a depressing character. It is to be borne in mind that whereas the warm bath causes cerebral anæmia, the hot bath gives rise to a determination of blood to the head. It is, therefore, contraindicated in persons suffering from vertigo and a tendency to cerebral apoplexy. It should also be interdicted in organic disease of the heart or great vessels and in the hemorrhagic diathesis.

Therapeutics. It is not consonant with the scope of this work to discuss the innumerable local uses of hot water in medicine and surgery. Its best application at our thermal springs and baths is found in the treatment of chronic rheumatism and gout, in the removal of chronic exudations from the joints, and in the manifestations of tertiary syphilis. Various local muscular pains and neuralgias are also favorably influenced. The thermal sulphur baths in some localities have attained a wide celebrity in the treatment of some of the obstinate squamous eruptions of the skin, more particularly eczema, psoriasis, and lichen. The hot hip-bath is useful in a variety of painful and irritative states of the pelvic viscera. In vesical tenesmus, retention of urine, dysmenorrhœa, ovarian neuralgia, and chronic inflammations of the uterus and adnexa the systematic use of the hot hip-bath is frequently attended by excellent results. The hot bath is very serviceable in infantile and uræmic convulsions and puerperal eclampsia, and in hepatic and renal colic, but it is seldom employed for these conditions at mineral springs. The hot bath as well as the warm bath is best taken early in the morning or in the evening before retiring. The bather should not expose himself to the open air for at least half an hour after the bath.

For a full account of the therapeutic application of the sitz-bath, as well as the half-bath, the foot-bath, and other partial baths, the reader is referred to special works on hydrotherapeutics.

The Douche. This is an ancient method of applying water, and was in active use among the Romans. Through the labors of Charcot, Fleury, and others this hydriatric procedure has been greatly elaborated in France. In one form or another it will be found at all of the principal American spring resorts. To the ordinary thermic action of the water upon the skin is added the mechanical influence of its impact against the body, which may be modified by regulating the size and number of the streams and the force with which they strike. The mechanical effect being instantaneous, the douche may be used at a lower temperature than other baths. The colder the water and the more brief the application the more complete the reaction. Below 55° F. it should never be applied to one part of the body longer than one minute. In accordance with the manner of projecting the water, douches have received various names.

The ordinary shower-bath is a *descending* douche. The *ascending* douche employed in diseases of the rectum, vagina, and uterus, is formed by an elastic rubber tubing of convenient length attached to a reservoir containing the water, and terminated by metal tips perforated by one or many openings as the case may be. The water of these douches is usually tepid or warm.

The *ring* or *circular douche* is a cylinder formed of coiled pipes rising one above the other to a height of six feet, and having a diameter of about two and one-half feet. These pipes are perforated on the inside, and when the patient is within and the water turned on he is showered from every point of the circumference.

The *universal douche* is a similar contrivance by which the patient is showered from every direction, above and below as well as on all sides.

The *fan douche* is a metal tip spreading out like an ordinary fan, with openings at the distal end of the fan.

The *spout bath* is a douche of great power. It is formed by an orifice of from one to two inches in diameter, from which the water is projected over and downward from a height of five or six feet. The patient, usually reclining on a slab, is placed under the stream, which flows, hot or cold, upon the diseased part.

The *Scotch douche* consists of alternating streams of hot and cold water.

The *douche mobile* is a movable douche, connected by a flexible rubber hose with the reservoir, which enables the attendant to direct the stream upon any part of the body. The size and number of the streams may be changed at will by screwing various nozzles upon the base. We may thus have a movable shower spout or a filiform douche, as desired.

The *rain bath* is a form of douche in which the water is precipitated in fine streams from a height of not less than forty feet.

PHYSIOLOGICAL ACTION OF THE DOUCHE. According to Baruch,[1] this is as follows: The nervous centres are aroused, the respiratory acts are deepened, the circulation invigorated, and the secretions increased. Locally the douche may be described as practically a thermic massage. It intensely excites the nervous and vascular structures and promotes the absorption of pathological products.

THERAPEUTICS. As a general invigorant the douche in its various forms excels all other hydriatric procedures in cases where muscular energy is in abeyance, whether this adynamia be primary or secondary to other conditions. The ergograph of Mosso, which registers automatically the muscular resistance, shows that the Scotch douche doubles, the rain bath trebles, and the ordinary tepid bath greatly increases the amount of work the muscles are capable of doing. It may, therefore, be employed to strengthen the muscles of feeble children and youths and to invigorate the lax fibres of men whom circumstances do not permit to indulge in normal exercise in the open air (Baruch). "In anæmia and chlorosis, in hypertrophies of the liver and spleen, in neurasthenia of the depressed type with morbid introspection and melancholy ideas, and in gastric and other troubles requiring a heightening of muscular energy, in a word, in all those conditions in which an elevation of nerve-tone is demanded, we have in the douche a most powerful weapon for good, and, I may say, for evil." The closing words of this quotation fittingly call attention to the care and circumspection required in handling so potent an agent. The temperature, pressure, and duration of the current, as well as the constitutional peculiarities of the patient, demand the most careful consideration.

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[1] The Uses of Water in Modern Medicine, 1892.

CHAPTER X.

BATHS AND DOUCHES AND THEIR MEDICINAL USES.—(*Continued.*)

The Vapor Bath. This is prepared by saturating the atmosphere with hot steam. In the form of the *Russian bath* it is widely used in our various bathing establishments and hydriatric institutes. The bather enters a dressing-room or antechamber warmed to 90° or 95° F. After undressing he passes, lightly covered, into the bath-chamber, which contains on one side rows of cots or benches, one above the other, like the beds in a state-room. The temperature of the bath will vary with the altitude of the cot, the lowest being about 95° F., while the upper one may be as high as 160° F. The room is saturated with moisture, and the bather on first entering might imagine himself surrounded by a dense fog. Owing to this moisture exhalation from the surface is at once effectually arrested, and this fact, added to the superheating of the air, renders the higher degrees of heat very oppressive, so that few bathers can tolerate a temperature above 120° or 125° F. The bather is made to lie on one of the benches, beginning with the lower temperatures and gradually increasing the heat by mounting to a higher bench. The first sensation on entering the room is one resembling suffocation, but after being subjected for some time to the influence of the hot, moist air, transpiration reaches its full activity, and the sensation is very pleasant. The attendant now comes and rubs the body vigorously with various irritating and cleansing substances, such as a hempen wisp, or the inner bark of a lime-tree previously soaked in soapsuds. He then holds the bather under a jet or shower-bath of ice-cold water. The skin being so intensely hot the sensation is very agreeable, and no fear of cold need be apprehended, provided the contact of cold be brief. The shock is severe, but is followed by a feeling of great comfort. The duration of the bath for beginners is about fifteen minutes, but old habitués may remain half an hour or even longer. In regular bathing establishments the bather goes, after the bath, to an adjoining room and reclines on a sofa or bed till cool, usually partaking of some warm drink. If copious perspiration is desired the patient is wrapped in blankets and reclines for a time before issuing forth. The Russians, however, often dress in the open air, and instead of using the jet of cold water go and roll themselves at once in the snow.

Physiological Action. The hot vapor bath produces reddening and congestion of the surface, quickening of the pulse, fulness of the head, and a sensation of weight and oppression in the chest. The body temperature is undoubtedly elevated for the time being.

A modified Russian bath is in use at a number of our spring resorts. The hot vapors and fumes, chiefly sulphurous, with a certain amount of steam from the water, are conducted into a suitable apartment having a temperature ranging from 100° to 140° F. as desired. The patient remains in this chamber for a few seconds, or several minutes, as the case may be, and is afterward treated to a cold affusion or plunge. Care should be taken that no sulphurous or sulphuric anhydride is present in the vapor, as these gases are poisonous. Several of the Rocky Mountain resorts possess natural caves or caverns of considerable size, the atmosphere of which is saturated at all times with hot sulphurous vapors, maintaining a temperature in the cave ranging in some cases as high as 110° or 120° F. The requisite auxiliary facilities have been provided at some of these resorts, and a very serviceable natural vapor bath is thus improvised.

The Hot-air Bath. The form of hot-air bath now in use in this country as well as in Europe is known as the *Turkish bath.* The bather first enters the disrobing room, having a temperature of about 80°. After undressing he is supplied with a light gown and wooden-soled sandals. He next passes into a chamber having a floor of marble or slate, and walls of tile, known as the *tepidarium,* and having a temperature of 120°. Here he reclines on a couch for a period ranging from ten to twenty minutes. He is next conducted into an apartment called the shampooing-room, having about the same temperature. Here he is placed on an elevated marble table, and the body in all portions is thoroughly rubbed, kneaded, and massaged by the attendant. From thence he is ushered into a very hot room, termed the *caldarium,* and having a temperature of 160° to 170° F., or, perhaps, even more. The walls and floors are here found to be burning to the touch, and the need of the sandals becomes apparent. Here the perspiration begins at once to break forth upon all parts of the body, and a pungent, burning sensation is experienced about the nostrils. After ten or twelve minutes the bather is again conducted to the shampooing-room and douched with warm water at 98°, and thoroughly rubbed and flagellated with wisps of hemp or sea-grass, or with a fine, medium, or coarse, flesh-brush, at his own option. In some establishments an implement of antique pattern, known as the *strigil,* is still in use, and with this the attendant scrapes the body and extremities. The bather is next showered with cooler water at 90°, then douched with water at 70°, which causes a good deal of shock and terminates the bath. He is then led to the dressing-room, and after being thoroughly dried, reclines on a couch, enjoying the pleasurable "*dolce far niente*" condition in which he finds himself. This is the hot-air bath usually described in works on balneotherapeutics. In Turkey, however, it appears that the chambers are not heated so high, the temperature of the caldarium not being above 105° F. The technique of the bath varies somewhat at the different resorts and sanitariums in this country. The following account of a tour of one of the most modern and elegant bathing establishments in New York may be of interest :

"Entering the beautiful marble vestibule to the baths, you step into a cosey office and place your money and valuables in a large envelope, which you seal and place your name on. The clerk locks this up in a compartment of the vault and gives you the key, together with the key to your dressing-room, attached to a rubber ring, which slips on your wrist. The attendant shows you to your dressing-room, which is one of the many openings out of the main hall, or large cooling-room, like state-rooms on a steamboat. When disrobed and ready for your bath, with a wrap about the loins, you are led down a short flight of steps to the first hot room, the temperature of which is 135° F. Here you remain, lounging or reading, until the pores of the body are opened sufficiently to induce a free perspiration. Adjoining this room is one in which the heat is increased to 165°, and into this you are taken if you do not perspire profusely enough in the first room. After leaving the hot-room you can, if you choose, enter the steam or Russian bath, which is kept at a temperature of 110° or 112° F. (a majority of bathers make use of this room for a few minutes). After receiving the benefits of the steam-room you are taken to the first massage-room. Here, in a temperature of 110°, you are thoroughly manipulated and scrubbed with brush and soap. After this external purification follows a shower-bath, which, beginning with warm water, to thoroughly cleanse the body of soap, becomes gradually cooler until the temperature of the plunge is reached. The tank-room is spacious and beautifully appointed. The marble-tiled floors and richly decorated walls, the graceful palms, and musical drip and spatter of the water fulfil the conceptions of the luxurious baths of the Roman Empire. In the centre of the room is the great oblong tank, over fifty feet in length and almost twenty feet in width. Steps descend into the water at either end, and the sloping bottom of the pool affords graduated depths for the swimmer. The temperature of the water is 70°, and a sudden plunge into it is stimulating and exhilarating. Electric lights, located under the water, diffuse a luminous glow through it, and add to the pleasure of the swim. After disporting yourself for a while in the tank, you may, if you so desire, enter the needle shower-room, which is fitted up with a liver spray, a jet, a douche, and other appliances for special needs. By this time you are ready for the drying-room, and here, in a temperature of 90°, you are rubbed dry with soft Turkish towels. In the second massage-room you recline on a leather couch and receive a thorough rub with alcohol or cologne. As the strong, supple fingers of the attendant pass swiftly, but lightly, over the body, a sense of comfort and repose is the immediate result. . . . Retiring to the spacious cooling-room upstairs, where the temperature is 80°, you are wrapped in Turkish bath-robes and placed on a reclining couch, where you may enjoy a cigar, a cup of the best French coffee, or, better still, a refreshing nap."

In some hydriatric establishments hot air or vapor cabinets are provided for those who, for any reason, are disqualified from inhaling the superheated atmosphere of the bath. Both Turkish and Russian baths are contraindicated in organic disease of the heart or bloodvessels, lungs or brain, and in all acute diseases. They are to be used with circumspection by stout, full-blooded persons, and especially by those having a tendency to vertigo or fulness in the head.

PHYSIOLOGICAL ACTION OF THE TURKISH BATH. The higher temperatures of the Turkish bath produce a smallness and frequency of the pulse, a feeling of tightness and constriction in the forehead, and in beginners a slight smarting and itching of the entire body. There is a pungent, burning sensation about the nostrils, and the skin feels hot. The pulse soon becomes fuller, although still quick, while the temporal and other superficial arteries throb. The skin is soon covered by a profuse perspiration, and the mouth may be dry. The first effects of the Turkish bath may be somewhat depressing, especially in those unaccustomed to it, but it must be confessed that the old habitué enjoys every moment, from the time he enters the first hot-room until he saunters forth into the open air again to renew his vocation in the busy outside world.

THERAPEUTICS OF THE RUSSIAN AND TURKISH BATHS. Both of these baths are superlatively cleansing and probably contribute to the general well-being by promoting the activity of the skin. By virtue of their stimulating influence on the skin they relieve some of the labor of the kidneys, and may thus become valuable auxiliaries in renal affections, especially when the urine is scanty and of high specific gravity. They are also of considerable benefit in conditions due to the uric-acid diathesis, notably in chronic rheumatism, chronic articular gout, sciatica, lumbodynia, and in eczema and psoriasis. It has seemed to the author that while these baths are followed by a most grateful result in chronic rheumatism with painful, stiffened joints, yet their influence is only temporary, and it is important at the same time to keep the patient fortified with salicylates or alkalies. The Turkish bath is very beneficial in wakefulness, and often induces a refreshing sleep in persons whose minds are disturbed by business cares and anxiety. It has also been found advantageous in some cases of obstinate dyspepsia where other measures have failed. It is further a very useful aid in the treatment of diabetes, torpidity of the liver, and functional jaundice. Hot steam-baths may be used with advantage in catarrhal affections of the nose, throat, and bronchi, and even in the incipient stages of non-hemorrhagic phthisis.

The Roman bath is simply an application of massage with the use of unguents, either with or without the Turkish bath. It affords the invigorating results of moderate muscular exercise without the fatigue usually attendant upon walking, riding, or work in the gymnasium.

Electro-thermal and Magnetic Baths. Patients are often treated while in the bath by means of the galvanic or faradic electrical current. It is believed that the moisture upon the surface (water being an excellent conductor) facilitates the operation of the electric current upon the nerve-centres and greatly augments the ordinary therapeutic efficacy of this agent. It was once supposed that several mineral springs in different parts of the United States were naturally charged with magnetism from the earth. It has long since been learned, however, that the magnetic phenomena observed in the water were due to accidental circumstances, although several well-known springs still retain the name of "magnetic." (*Vide* Springs of Michigan.)

The **soda bath** is simply a bath containing a large percentage of chloride of sodium or common salt.

The Mud or Moor Bath. Mud bathing, or terratherapy, is of ancient origin. Ample evidences exist to show that it was in common use among the American aborigines. At a number of our spring resorts the earth surrounding the fountains becomes more or less saturated with the mineral ingredients of the water. It may be of sufficient heat and of proper consistency to apply directly to the skin; but at most places it is placed in a large vat and mixed with the mineral water, either naturally or artificially heated, until it becomes plastic. The patient then immerses himself in this hot mineral mud, or reclines on a table and is plastered with it by an attendant. The bath may vary in duration from a few minutes to several hours. The mud, being a low conductor of heat, may be used at a higher temperature than water. It is said that 120° F. is well borne. The patient now enters a warm-water bath, where he is thoroughly cleansed, rubbed, and dried, and in some cases treated to a cold shower-bath or other cold affusion.

PHYSIOLOGICAL ACTION OF THE MUD BATH. It was once supposed that the mud applied in this way absorbed toxic and detrimental material, such as uric acid, metallic poisons, etc., from the skin. This theory, however, has been abandoned. Nor, indeed, is it probable that the constitution of the mud materially influences its action, which is essentially that of a universal hot poultice. Its chief effects are shown in a lively excitation of the skin, followed by free perspiration.

THERAPEUTICS. In localities where mud-baths are in vogue it is claimed that they are of great benefit in chronic rheumatism, stiff joints, old glandular swellings, and in chronic diseases of the skin. They are also recommended in chronic hypertrophic states of the liver and spleen, in renal diseases, and in old inflammations involving the uterus, ovaries, and bladder. The mud bath is sometimes used locally in the form of a knee-bath, a foot-bath, or an arm-bath.

The Peat Bath. This bath is still in high favor at several of the European spas, notably at Franzensbad. Peat consists of a dense mass of decomposed stalks and roots, the product of the decomposition undergone by vegetable growths flourishing in shallow, standing mineral water, in the absence of atmospheric oxygen and at a moderate and equable temperature. Every autumn the peat is dug up by means of specially constructed machines, and thrown upon the slope of a hill, where it lies for months, undergoing a process of oxidation, during which the sulphurets are converted into sulphates, while out of the organic constituents are formed the final products of dry distillation, such as formic, acetic, and humic acids. The dry or weathered peat is ground in mills constructed for the purpose, and the baths are prepared by mixing it with hot mineral water and stirring it vigorously. A peat bath should invariably be followed by a bath of mineral water, using soap, bran, or other substances to secure perfect cleanliness.

Physiological Action of the Mineral Peat Bath. On the one hand it is sedative and tonic, and on the other hand it is stated to be absorbent and antimycetic. According to Prof. Frerichs, it is of great value in glandular enlargements, exudative contractions, chronic rheumatism, sciatica, and other affections. It is often used in the form of the half-bath, the hip-bath, the foot-bath, and in the form of fomentations to local, painful conditions.

The Carbonic-acid Bath. In many of our mineral springs carbonic anhydride is an abundant and important gaseous ingredient. Its physiological effects upon the skin are readily appreciated by the bather. The regular carbonic-acid bath, however, is prepared by collecting the air in an impervious box, in which the bather remains seated, while the head is in the outer air, precautions being taken that not enough of the gas escapes from the box to injure the patient. The acid produces on the skin a lively sensation of warmth with redness and formication, attended by a diminished pulse-rate and coldness of the feet. The bath is followed by a sense of vigor and activity.

Carbonic-acid baths have been found useful in recent paralysis, neuralgia, and rheumatism. They are also recommended by Frerichs in sexual neurasthenia, in various nervous disturbances characterized by local anæsthesia and hyperæsthesia, and in reflex and hysterical paralysis. The gas is also used locally in throat and other troubles by means of apparatus devised for the purpose.

The Kneipp System. A word of explanation regarding the

"Kneipp Cure," devised by a priest of Bavaria, may be admissible here. The Kneipp system embraces certain hydriatric procedures, the use of simple household remedies, and a regulation of the mode of life. In order to "strengthen the nervous system" the patient is instructed to bathe his feet in cold water, or, better still, to take regular early morning walks barefooted on the dew-covered grass. This is, perhaps, the most striking feature of the system, but Kneipp also employs the cold pack, the warm bath, cold affusions, and other hydrotherapeutic methods.

The **sun bath** and the **sand bath**, as well as other procedures which might be termed balneary, hardly warrant a description here.

Schott-Nauheim Treatment.[1] This chapter would not be complete, however, without a brief reference to the bath and graduated exercise treatment of chronic heart disease, inaugurated at Nauheim by the Messrs. Schott Brothers, and known as the Schott-Nauheim Treatment. The following table shows the composition of the waters of the two principal springs now in use at Nauheim, taken from Eulenberg's *Real Encyclopädie der Gesammten Heilkunde:*

SPRINGS OF NAUHEIM.

One U. S. gallon contains: Solids	Friedrich Wilhelm's Quelle. Grains.	Grosser Sprudel. Grains.
Sodium chloride	1707.84	1272.73
Potassium chloride	65.22	28.97
Calcium chloride	187.95	99.11
Magnesium chloride	30.60	25.65
Calcium sulphate	2.04	1.98
Calcium carbonate	151.63	137.23
Iron carbonate	2.79	2.21
Total	2148.07	1567.88
Carbonic acid (free)	160.52[2]	197.65[2]
Temperature of water	98.5° F.	88.8° F.

In accordance with the classification adopted for this work these waters may be denominated as strong muriated-saline carbonated waters with ferruginous properties. It will be observed that they are also thermal. The springs spout forth in foaming white currents only thirty-two feet apart, high above the surface of the ground. They are connected with five bath-houses, four in the immediate neighborhood and a fifth at a little distance from the others. Drinking of the water plays but a secondary part, but their internal use is of some value in gouty conditions and disorders of the liver. We are informed that the baths at Nauheim regulate the action and improve and strengthen the nutrition of the diseased heart, whether depending upon valvular lesions or upon malnutrition or disease of the muscular structure of the organ. These results are stated to be due to the chloride of sodium, the more irritating chloride of calcium, and to the free carbonic acid, of which, as we have seen, the water contains large quantities. During the bath there is a slowing of the pulse, with increased volume and strength, and irregularity, if any exists, is lessened or disappears. These effects do not appear at once, but persist for a considerable period after the bath.

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[1] Vide article by Dr. W. C. Rives in Foster's Reference Book of Practical Therapeutics, 1897, vol. ii. p. 419.

[2] In the original analysis the quantitative estimates are made in parts per thousand. The carbonic acid gas is expressed in cubic centimetres, presumably cubic centimetres per litre, which would be equivalent to so many parts per thousand, in conformity with the other chemical contents.

The baths may be called cool, being used at 92° or 93° F. at first, and gradually lowered to 87° or a little less toward the end of the course. Even at 92° the water imparts a distinct feeling of chilliness as the patient enters the bath. From five to eight minutes as the initial limit, the baths gradually reach a duration of twenty minutes, the time being increased cautiously with the progress of the treatment and the improvement of the patient's condition. The quality and rate of the pulse furnish the most reliable index to the action of the baths. The light exercise, or gymnastics, as the Messrs. Schott choose to term this part of their cardiac therapeutics, is a very simple but exceedingly important adjunct to the baths. The individuality of this treatment lies in the application of counter-resistance made by an attendant trained for that purpose. It is important that the movements be performed slowly and steadily, that they be interrupted by short periods of repose, and that the effort exerted by the patient be not so great as to cause embarrassment of respiration or undue acceleration of the pulse. These exercises exert an effect on the heart and circulation similar to that of the baths, and, therefore, supplement and reinforce the balneary treatment. This method, however, is strongly contraindicated in degenerative changes of the bloodvessels and myocardium. They should not be used, for example, in aneurism and advanced arterio-sclerosis, nor in acute softening or advanced fatty degeneration of the heart.[1]

Artificial Nauheim baths may be prepared, as Dr. John Broadbent points out, by the use of sea-water which contains a large proportion of chloride of sodium. For the production of carbonic acid a suitable proportion of commercial muriatic acid and bicarbonate of sodium, or chalk, may be used. A mixture of the bicarbonate and bisulphate of sodium has also been suggested for this purpose. A preparation known as the Nauheim *mutterlauge* (mother-lye) is also on the market. It is the uncrystallizable liquid remaining in the manufacture of salt at Nauheim, and is said to be coming into favor for the artificial production of the baths. Many of our American springs contain the requisite ingredients for these baths, and the Nauheim treatment has been adopted at several home resorts.

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[1] For a complete exposition of the Schott method see work by W. Bezley Thorne: The Schott Method of the Treatment of Chronic Diseases of the Heart. London, 1895.

PART II.

THE MINERAL SPRINGS AND WELLS OF THE UNITED STATES.

ALABAMA.

Alabama extends from 30° 12′ to 35° north latitude, and from 84° 55′ to 88° 35′ west longitude, and is in the same latitude as Palestine, Northern Africa, Central China, and Southern Japan.

Although much of the surface has been cleared for cultivation, large forests of hickory, poplar, chestnut, oak, mulberry, and other deciduous trees still cover the northern portion of the State, while in the south the magnolia, live oak, and other subtropical evergreens flourish, and the river bottoms are lined with canebrakes and cotton-wood trees.

The climate is warm and semi-tropical. The uplands are healthy, but in the low-lying districts malarial, bilious, and congestive fevers are common. The northern portion is considerably colder than the southern, which is accounted for more by its greater elevation than from its higher latitude. The Alleghany range stretches into the northern part, but the elevation is nowhere great. The mean annual temperature, as observed at Auburn, near the geographical centre of the State, is 62.37° F. The mean annual temperature in the valley of the Tennessee River is 60°, and in the extreme south about 69°.

The rainfall of the State is quite noteworthy, averaging 63 inches, which is distributed with tolerable regularity through the four seasons.

The beautiful Tennessee River drains the northern part of the State. Entering at the northeast, it makes a broad sweep of about 280 miles, and forms for a short distance the northwest boundary, before re-entering Tennessee, on its way to join the Ohio at Paducah, Ky. The central and southern portions of the State are well watered by the Alabama and Tombigbee Rivers and numerous smaller streams. The rate of mortality in the State as computed from the last United States census was 13.81 per 1000 of population. The total number of deaths from consumption for

1890 was 216, which was at the rate of 1.43 per 1000 of population, or 103.50 per 1000 of total deaths.

The mineral springs of Alabama are quite numerous, although but few of the waters are used commercially. In Peale's list[1] upward of twenty localities are mentioned as places of resort. Walton describes three, and Bell mentions three localities. In common with most of the Southern States, many of the spring resorts of Alabama have been allowed to languish in consequence of the war, and are now in a practically obsolete condition.

As a result of extended personal investigation, supplemented by correspondence with every locality described as a resort in the reports of the State and National Geological Surveys, the author has succeeded in obtaining recent information from ten localities. It is probable that this list fairly represents the spring resorts in use at the present day. It will be seen that chalybeate and sulphureted springs predominate, the latter especially in the northern counties whose rocks belong to the subcarboniferous limestones. Artesian wells are quite numerous in the region underlaid by the rotten limestone of the Cretaceous period. Many of these wells are said to be highly charged with salts of iron, lime, magnesia, and soda, although but few analyses have been made. Pursuing the alphabetical order, the mineral springs of Alabama may be described as follows:

BAILEY SPRINGS,

Lauderdale County.

Post-office, Bailey Springs. Springs Hotel. Access *via* Memphis and Charleston R. R. from east or west; also *via* the L. & N. R. R. from the north, and the Sheffield and Birmingham R. R. from the south; also by all steamboats on the Tennessee River. Tickets should be taken to Florence, Alabama, nine miles distant by carriage or stage.

The Bailey Springs have been used as a resort for upward of fifty years. They are located in a picturesque little valley surrounded by a semicircular range of hills and interspersed by many leafy arcades and rocky points.

The moss-banked stream, a short distance from the springs, known as Shoal Creek, is utilized by frequenters of the springs for boating and fishing. The hotel buildings are comfortable, old-fashioned structures situated on the summit of the hill, about 300 feet above the level of Shoal Creek. They have recently been thoroughly overhauled and brought up to modern requirements. The springs are seven in number and are known as the "Rock," "Brick," "Sulphur," "Freestone," "Soda," "Alum," and "Sour Iron" springs. The following qualitative analysis of the first three was made some years since under the auspices of the *Boston Journal of Chemistry*.[1]

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[1] Bulletin 32, United States Geological Survey.

BAILEY SPRINGS.

Alkaline-chalybeate.

Rock Spring.	*Brick Spring.*	*Sulphur Spring.*
Magnesium.	Carbonic acid.	Magnesium.
Calcium.	Sulphureted hydrogen gas.	Calcium.
Sodium.		Sulphur peroxide.
Chlorine.	Sodium carbonate.	Chlorine.
Chlorine peroxide.	Magnesium carbonate.	Iron.
Silica.	Potassium carbonate.	Silica.
Potassium.	Sodium chloride.	Sodium.
Carbonic acid.	Iron oxide.	Carbonic acid.
Ammonia, a trace.		Ammonia.

A more complete quantitative analysis is required in order to establish their proper classification.

The "Rock" Spring from the above analysis might be designated as an alkaline, and the last two as alkaline-chalybeate springs. The waters are recommended for renal disease attended by dropsy, for dyspepsia, and for anæmia and general debility. They are believed to possess sedative effects upon the nervous system, and in virtue of this action are prescribed in cases of restlessness and insomnia due to alcoholism, overwork, anxiety, etc.

The "Alum" Spring has acquired considerable reputation in the local treatment of skin affections, ulcerations, and inflammatory affections of the eye.

BLADON SPRINGS,

CHOCTAW COUNTY.

Post-office, Bladon Springs. Hotel and cottages. Access *via* Mobile and Birmingham R. R. to Carson Station, thence twenty-nine miles by hack to Springs; also, by Mobile and Ohio R. R. to Buckatunna, Miss., thence twenty-eight miles by stage or hack; also by steamer from Mobile, Tuesday and Saturday service. There is also a biweekly southbound steamer service from Demopolis. The springs are four miles from the steamer landing on the Tombigbee River.

For upward of thirty years the Bladon Springs have been a favorite resort for the best people of Alabama and the neighboring Gulf States. The steady influx of visitors of late years renders it necessary to keep the hotel open all the year.

The location is about eighty miles from the Gulf as the crow flies, and about 170 feet above tide-water. The climate is mild and equable, the mean annual temperature being 75° F. The nights are delightfully cool, averaging about 65° F. after 8 o'clock during July and August. The surrounding country is hilly and heavily wooded with pines, and excellently adapted for thorough drainage. The resort offers abundant inducement for those wishing to escape the rigors of a Northern winter. Game is abundant during the fall and winter months, and it is said that deer are killed within a mile of the hotel.

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[1] Furnished to the author by Dr. W. A. Moody, of Florence, Ala.

We are indebted to Dr. Showalter, of the Springs, for the following anlysis:

BLADON SPRINGS.

Alkaline-carbonated.

One U. S. gallon contains: Solids.	Vichy Spring. J. L. & W. P. Riddell.	Branch Spring. J. L. & W. P. Riddell.	Sulphur Spring. J. L & W. P. Riddell.	Old Spring. R. P. Brumby.
Sodium carbonate	46.33	41.21	34.93	32.89
Magnesium carbonate	0.29	0.61	0.65	1.36
Calcium carbonate	0.87	2.14	2 42	2.75
Iron carbonate	0.49	0.23	0.76	0.02
Calcium sulphate	2.25	2.79	2.96	..
Iron sulphate	..	..	..	0.24
Sodium chloride	..	..	..	7.69
Strontia	..	..	..	0.32
Silica	..	..	..	2.10
Organic matter	2.26	1.90	1.25	..
Crenic acid	..	..	..	0.75
Hypocrenic acid	..	..	..	0.60
Total	52 49	48.88	42.97	48 72
Gases.	Cubic inches.	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid	65.44	59.20	52.88	32.56
Sulphureted hydrogen	..	..	0.56	..
Chlorine	1.84	1.84	1.84	..
Total	67.28	61.04	55.28	32.56

The waters are of the alkaline type, quite plentifully charged with carbonic acid. They are useful in chronic indigestion, in the syphilitic cachexia, in advanced nephritis, diabetes mellitus, and rheumatism.

BLOUNT SPRINGS,[1]

BLOUNT COUNTY.

Post-office, Blount Springs. Hotel. Access *via* Alabama and Chattanooga R. R., also *via* Louisville and Nashville R. R. to Elyton.

The Springs are about thirty miles northwest from this station.

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[1] From Walton and the United States Geological Reports. No recent reports of these springs obtainable.

The waters of Blount Springs may be classed as saline-sulphureted. The springs are six in number, and are located in a triangular valley, 1580 feet above the sea level.

BLOUNT MINERAL SPRINGS.

Saline-sulphureted.

One U. S. gallon contains: Solids.	No. 1. Red Spring. R. T. Brumby.	Sweet Spring. Brumby.	Spring No. 4. Summers.
Magnesium carbonate	4.40	3.60	9.40
Calcium carbonate	6.80	4.48	5.72
Barium carbonate	. .	. .	0.91
Iron carbonate	1.92	1.12	3.19
Sodium sulphate	. .	. .	. .
Magnesium sulphate	1.60	2.40	. .
Calcium sulphate	. .	. .	1.27
Calcium phosphate	. .	. .	Trace.
Potassium chloride	. .	. .	7.07
Sodium chloride	32.32	30.88	23.21
Magnesium chloride	6.00	. .	2.04
Iodides	. .	. .	. .
Magnesium iodide	. .	. .	0.14
Magnesium bromide	. .	. .	0.16
Lithium	. .	. .	Trace.
Alumina	. .	. .	Trace.
Silica	. .	. .	2.44
Sulphur	. .	. .	. .
Total	53.04	42.48	55.55
Gases.	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid	6.00	6.00	4.72
Sulphureted hydrogen	14.96	12.56	30.67
Oxygen	. .	. .	7.08
Nitrogen	. .	. .	

CHANDLER SPRINGS,

TALLADEGA COUNTY.

Post-office, Chandler Springs. Hotel. These springs are located in a picturesque region twelve miles southeast of the city of Talladega, from which they are reached by stage. The line of survey of the Macon and Birmingham R. R. passes within half a mile of the location.

The place has been used as a health resort since 1838, and prior to that time the waters of the springs were employed by the aborigines. Many medicinal plants used by the Indians grow in the neighborhood.

The elevation of the springs is about 1000 feet above the sea-level. The prevailing summer weather is bright and clear. The average summer temperature ranges from 60° to 85° F.; winter, 25° to 40°.

The surrounding country is of a mountainous character, a spur of the Blue Ridge approaching to within a distance of one mile. The springs are three in number and yield an abundant flow of water, having a temperature in summer of 58° or 60° F. No analysis has been made, but the waters are probably alkaline and contain a trace of iron.

THERAPEUTICS. Chandler Springs are resorted to by those suffering from obstinate lumbago, sciatica, rheumatism, renal and bladder disorders, and dyspepsia.

COFFEE SPRINGS,

GENEVA COUNTY.

Post-office, Coffee Springs. Hotel. From Geneva, the county seat of Geneva County, ten miles distant from the Springs by stage, or by Alabama Midland R. R. to Ozark, thirty miles distant by private conveyance.[1]

In years gone by the Coffee Springs enjoyed a great reputation among the people of Central and South Alabama, but, sharing in the general decline of this region incident to the Civil War, they have lost much of their old-time prominence. Improvements are under contemplation, however, which it is hoped will restore the resort to something like its former attractiveness and place in popular esteem.

The springs are located in a rolling stretch of country, sixty miles north of the Gulf coast and about 1000 feet above the sea-level.

The summer weather is generally clear, and the mercury seldom rises above 90° F. The winters are very mild, with occasional light frosts, but very little ice. The flow of water is estimated at about 100 gallons per minute from two large and several smaller springs.

According to an old and incomplete analysis, the water contains sulphur, magnesia, lime, iron, and alum.

We are informed by Dr. Frank Heath, of Coffee Springs, that the waters are highly prized in renal, hepatic, and gastric disorders, and in chronic rheumatism.

HEALING SPRINGS,

WASHINGTON COUNTY.

Post-office, Healing Springs. Numerous cottages. Access: Buy ticket to Buckatunna, Miss., on the Mobile and Ohio R. R., seventy miles north of Mobile; then take hack to Springs, fourteen miles east.

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[1] According to a recent map the West Florida and Northern Railroad now passes through Coffee Springs.

These springs were discovered in 1870, and have since attained considerable prominence as a health resort. The surface of the country about the springs is broken by high ridges and slopes, and covered by the long-leaved yellow pine. The soil is sandy, and the location has an elevation of about 400 feet above tide-water. Like all resorts in this latitude, the winters are mild, the temperature seldom dropping below the freezing-point. The summers are not exceptionally hot, the mercury almost always sinking to 68° or 70° F. at night. During a recent summer the highest temperature observed was 92°.

The springs are eleven (11) in number, but only four are much used. The "Creek" Spring boils up in the centre of a small stream and flows about eight gallons per minute. It is said to contain lithia, iron, and a trace of arsenic. "Mound" Spring, yielding thirteen and a half gallons per minute, issues from a small mound five or six feet higher than the ground around it. Iron, magnesia, lithia, and sulphur are said to be among its ingredients. "McCarty" Spring, supplying seven gallons per minute, is supposed to contain an acid of some kind and also iron. Its waters are used extensively for chronic diarrhœa. "Scholes" Spring contains iron and sulphur. Many varieties of skin affection, chronic renal diseases, and disorders of the bladder, alimentary tract, and liver, are said to receive benefit from the waters of the Healing Springs.

HOWARD SPRINGS,

LAUDERDALE COUNTY.

Post-office, Florence. Hotels at Florence. These Springs are located one and a half miles from the Tennessee River, and half a mile from Florence at the junction of the Memphis and Charleston and Louisville and Nashville Railroads.

The river is navigable for ten months of the year. Florence has a population of 8000, and possesses abundant hotel facilities.

The climate in this neighborhood is mild and equable and not subject to sudden changes. In 1890 the highest temperature was 89.5°; lowest, 64° F. The average summer temperature ranges from 79° to 84°, and the nights are almost always cool, requiring light blankets. The usual winter temperature ranges from 54° to 58° during the day, and from 40° to 48° at night. The coldest weather ever known in Florence was in January, 1893, when the mercury fell to 9.5° above zero.

The elevation is about 1100 feet above the sea-level, and the surrounding country is gently undulating.

The springs are three in number. No quantitative analysis has been made, but according to an old qualitative examination by Prof. Tuomey, State Geologist, Spring No. 1 contains:

Hydrochloric acid.
Sulphuric acid
Sulphurous acid.
Calcium carbonate.
Iron carbonate.
Alum.
Magnesia.

Another spring is said to contain ferric alum in large proportions, and has considerable reputation in the treatment of diarrhœa and dysentery. The third spring, about 500 feet distant from No. 1, contains sulphur, and is used in skin diseases. The waters of No. 1 have had an extensive reputation in the treatment of Bright's disease, diabetes, and other disorders. For various reasons these springs have been more or less neglected since the Civil War.

LIVINGSTON ARTESIAN WELL,

SUMTER COUNTY.

Post-office, Livingston. Hotels. Livingston, the county-seat of Sumter County, is located on the Alabama Great Southern R. R., a part of the Queen and Crescent route operating, with numerous connections, between Cincinnati, Ohio, and New Orleans, La.

The town is situated on a sandy plateau with perfect underdrainage. The climate at Livingston furnishes a fair type of the atmospheric conditions prevailing in central Alabama. The warmest weather recorded by standard Signal Service instruments for many summers has been 97°, and this elevation has been very rare. The coldest weather noted in winter has been 20° above zero. The average temperature of the year is 63°, and the average rainfall 56 inches.

Geologically, the well is located at the extreme southern outcrop of the cretaceous limestone, which forms the basis of the rich belt of prairie land extending through middle Alabama. It pierces the entire thickness of the limestone stratum to reach the underlying sandstone formation in which the water is procured.

The depth of the well is 1087 feet, and the flow of water one gallon per minute. It was bored with a view to obtaining a supply of good drinking water, but it proved decidedly saline, and at first the venture was thought to have been a useless expenditure of time and money. By degrees, however, the citizens began to use it, and though at first disagreeable to the taste, it soon became a favorite beverage. Certain medicinal effects were observed, especially in dyspepsia and chronic bowel disorders, and little by little the well finally acquired considerable local celebrity. The water is beautifully clear and limpid and effervesces actively when drawn from the spout. The specific gravity of the water is 1003, and its temperature, which does not vary at any season, is 68° F.

From a circular issued by the town authorities we have obtained the following analysis by an unnamed chemist:

LIVINGSTON ARTESIAN WELL.

Saline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Silicic acid and silicates	1.14
Iron bicarbonate	0.20
Magnesium bicarbonate	2.32
Calcium bicarbonate	7.14
Iron perchloride	0.19
Magnesium chloride	1.84
Calcium chloride	2.98
Potassium chloride	0.33
Sodium chloride	295.43
Strontium chloride	Trace.
Sodium bromide	0.98
Total	312.55

Gases.	Cubic inches.
Free carbonic acid (in solution)	21.47
Carbonic acid in combination as carbonates	9.32
Total gases	30.79

As may be inferred from its composition, this water possesses aperient, tonic, and diuretic properties. It is said, furthermore, to have decided alterative influences on the economy. According to Dr. R. D. Webb, of Livingston, who has made a special study of this water for many years, it is highly beneficial in cases of chlorosis, malarial anæmia, affections involving the alimentary tract, the kidneys, and the bladder, and in nervous exhaustion.

MATCHLESS MINERAL WELLS,

BUTLER COUNTY.

Post-office, Greenville. Hotels in Greenville. These wells, two in number, are situated two and a half miles from Greenville, a pleasant little town of about 4500 inhabitants, in the pine region of Alabama. Greenville is located on the main line of the Louisville and Nashville R. R., forty-four miles south of Montgomery. The following somewhat remarkable analysis of the water of these wells is said to have been made by Professors E. A. Smith and J. B. Little, and to have been indorsed by Prof. Henry W. Leffmann, of Philadelphia:

MATCHLESS MINERAL WELLS.

Acid-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sulphuric acid	314.09
Ferric oxide	86.53
Ferrous oxide	81.38

One U. S. gallon contains:

Solids.	Grains.
Calcic oxide	24.53
Magnesic oxide	22.71
Potassic oxide	1.11
Alumina	3.65
Silica	5.04
Sodium oxide	4.09
Chlorine	2.47
Total solids	545.60

Carbonic acid undetermined.
Specific gravity of water 1007.

This analysis shows the water to be a powerful chalybeate. It is bottled, and is said to have an extensive sale in the South. The water is recommended for dyspepsia, diarrhœa, anæmia, general debility, etc. As a local application it is used in indolent ulcerations and hemorrhoids, as an injection in gonorrhœa and vaginitis, and as a spray or gargle in throat affections. The dose as a tonic is 1 to 2 drachms three times a day, diluted with plain water; as a cathartic, 6, 10, or 12 drachms in an equal quantity of water.

WHITE SULPHUR SPRINGS,

Calhoun County.

Post-office, Jacksonville. These Springs are situated seven miles from Jacksonville, the county-seat of Calhoun County.

The springs do not seem to have been much improved as yet, although the neighborhood possesses many attractions as a health resort. The country about the springs is hilly and interspersed with valleys. The elevation of the springs is 380 feet above the sea-level. Some of the surrounding hills reach an altitude of 640 feet.

Within a few miles of this location, Gen. Coffee fought the battle of Tallushatchee with the Creek Indians under Wethersfield. The climate is balmy and equable and not subject to sudden changes. The most important spring is said to be sulphurous. Two contain lime, and one each is said to be chalybeate and freestone. The waters are described as being useful in dyspepsia and kindred disorders and in impure states of the blood.

Other spring localities in Alabama which are, or have been, used as resorts are as follows: The Blue Grass Sulphur Springs in St. Clair County; Butler Springs in Butler County; Green Springs, Hale County; Jackson Springs, Clarke County; Milhour's Springs, Limestone County; Shelby Springs, Shelby County; Tallahatta Springs, Clarke County, and Valhermosa Springs, Morgan County. The State also has numerous undeveloped springs.

ALASKA.

Alaska extends from the Diomede Islands in Behring Straits in north latitude 66°, west longitude 168° 50′, eastward along the shore of the Arctic Ocean to west longitude 143°, north latitude 69° 30′, and from the Diomede Islands southward to north latitude 50°, west longitude 168°, thence eastward to the 143d meridian. The peninsula embraces an area of 577,390 square miles. The surface is broken and mountainous, and is traversed by the most northern range of the Rocky Mountains. The territory is well drained by the Yukon and Coppermine Rivers and their branches.

Thermometric observations show that the climate in the neighborhood of Sitka is not so cold as people of the United States are apt to believe. In a series of records made some years since, the average yearly temperature was 44°. The average for the coldest winter day was 3° F., and for the warmest summer day, 67° F. The coast is warmed by the Japan current, which in the Pacific is the counterpart of the Gulf Stream in the Atlantic. The average rainfall is between 80 and 85 inches, the fall months being especially wet.

The territory is richly endowed with springs. Many of them, no doubt, are highly mineralized, but the data concerning them are exceedingly meagre. There are numerous hot springs, some of which have been used by the Aleuts for cooking purposes for many generations. Beside the hot springs there are many which do not freeze, even in the coldest weather, and may, therefore, be properly classed as thermal. Chalybeate, sulphureted, and saline springs are also to be found. Peale's list gathered from various sources enumerates twenty-seven localities. According to Dr. William H. Doll,[1] many of these waters possess therapeutic properties of a high order.

The author is indebted to Ensign R. E. Coontz, U. S. N., for the following account of two localities:

HOONAH HOT SPRINGS.

These springs are located on Chichagoff Island, about ninety miles north of Sitka, and are reached by small boats or canoes. A few huts have been built in the neighborhood. The springs are about 60 feet above the sea-level, and are surrounded by a hilly country. The meteorological conditions are about the same as those prevailing at the Sitka Springs, but being farther north the winters are slightly colder. The temperature of the water is unknown, nor has an analysis been made, but the springs are much resorted to by miners and Indians for the treatment of blood and skin affections and rheumatism.

[1] Alaska and its Resources.

SITKA HOT SPRINGS.

Location on Baranoff Island, sixteen miles south of Sitka. They are reached from Sitka by boats only. Four houses have been built at this place, three with bath-rooms attached. In 1860 a hospital for rheumatism and skin and blood diseases was opened by the Russian-American Company. The baths were found to be exceedingly beneficial in syphilitic affections. The Indians have resorted to these springs for many years. They are about 30 feet above the sea-level, and distant from salt water about fifty yards. The springs are four in number, but the rate of the water flow is unknown. The temperature of the water is 120° F., and it is said to contain sulphur, iron, manganese, and chlorine. The weather in this region is generally clear during the summer months, with a temperature ranging from 60° to 80° F. The spring and fall seasons are rainy, and the winters cold and cloudy, the temperature varying from zero or a little below to 40° F. The spring season is considered preferable for visiting the springs.

Other hot springs are located on Chichagoff Island, about eighty miles from Sitka, to which no name has been given. Little is known concerning them, except that they have some reputation among the Indians in the same diseases as those mentioned above. Within half a mile of Sitka, on a road called Davis Avenue, there is an iron spring flowing from a rock. It has not been analyzed, but it was formerly esteemed by the Russians for its tonic properties.

ARIZONA.

Arizona extends from 109° to 114° 47′ 6.5″ west longitude, and from 31° 19′ 24″ to 37° north latitude, and comprises an area of 113,916 square miles, or nearly three times that of the State of New York.

After many years of bloody strife the Apaches and other hostile tribes of the territory have been subdued, and it is no idle statement that life and property are to-day as safe in Arizona as in any of the Eastern States.

The Rio Colorado, which runs through the northwestern part and along the western border, is the principal river of the territory. It is navigable for 600 miles, and with its tributaries drains an immense area of country. The Gila and Salt Rivers flow through southern Arizona. The climate is salubrious and pleasant, except in the lower sections near the Gila and the Rio Colorado, where the summers are excessively hot. Rainfalls occur during the months of June, July, August, and September, but numerous streams, fed by never-failing springs and melting snow, supply all the water that is needed for farming purposes.

The surface in this territory presents all varieties of conformation, from the low-lying plains to the seared, riven, and weird region of the north. The elevations above sea-level vary from 12 feet above, near Yuma, to 12,000 feet above in the San Francisco Mountains. In the northern mountains is the far-famed Grand Canyon of the Colorado River.

The latest United States Census returns show a mortality of 9.61 per 1000; deaths from consumption, 1.14 per 1000.

The Salt River Valley is of late years coming into great prominence as a health resort. This valley lies in the southern third of Arizona, and is about fifty miles in length, and averages about eighteen miles in width. It slopes ten feet to the mile toward the south and west, but to the eye looks perfectly level. The city of Phœnix, situated in its centre, has an altitude of 1030 feet. It is surrounded on all sides by low mountain ranges, the nearest to Phœnix being six miles distant. The climate of this region is semi-tropical. Perhaps the highest temperatures recorded in the United States are noticed here, the mercury at one observation at Tempé, near Phœnix, having registered 115.5° F. in the shade. The excessive dryness of the climate, however, prevents this high temperature from being very oppressive. The heat is much less felt than that of much lower temperatures in other localities. It is said that sunstroke never occurs, and malaria is unknown. The winters of the Salt River valley are very charming. The coldest days of the year are as mild as those of September in the Eastern States. The annual rainfall does not exceed seven inches, and, as a consequence, there are on an average at least 350 sunny days in the year. As a resort for persons suffering from pulmonary complaints these conditions of climate offer peculiar advantages, and there can be no doubt that a better knowledge of this region will cause it to be widely sought by this class of patients.

The following table shows the average monthly temperatures at Phœnix for thirteen years:

January . . .	49.0° F.	July . . .	89.0° F.
February . . .	53.9° "	August . .	88.0° "
March . . .	61.0° "	September . .	80.0° "
April	67.2° "	October . .	68.8° "
May	74.6° "	November . .	57.6° "
June	82.7° "	December . .	53.0° "

Phœnix is a well-built, enterprising city, now (1897) numbering 12,000 inhabitants, and has a taxable valuation of about $10,000,000. The city has many handsome public buildings and private residences. There are also a large sanitarium, eight hotels, and numerous lodging-houses.

The United States Geological Reports show a list of twenty-six spring localities in Arizona. There are, doubtless, numerous others of which no account has ever been taken. Numerous inquiries have failed to develop definite information of any of these springs. So far as can be ascertained none of them have been improved, although the Monroe Hot Springs, in Maricopa County (temperature 150° to 160°), are said to be used to some extent for bathing. In some portions of the territory alkaline, saline, and sulphureted waters are so numerous as to attract but little attention. Saline springs appear to be most abundant, and a large number of them are thermal. Many of them will doubtless come into use for medicinal purposes as the country becomes more thickly populated. Vol. III. of Wherter's *Survey Reports* furnishes the following analyses by Oscar Loew:

One U. S. gallon contains:	Mineral Park Bitter Spring.	Gypsum Spring.	Hot Spring.
Magnesium carbonate	. .	Trace.	. .
Calcium carbonate	. .	6.99	. .
Sodium sulphate	Trace.	30.08	. .
Magnesium sulphate	37.16	100.74	. .
Calcium sulphate	69.08	75.79	23.90
Iron sulphate	Trace.	. .	. .
Manganese sulphate	"	. . .	. .
Sodium chloride	. .	232.95	189.47
Potassium chloride	. .	Trace.	. .
Magnesium chloride	3.14	. .	59.46
Calcium chloride	. .	. . .	115.43
Total	109.38	446.05	388.26

The Mineral Park Bitter Spring, as shown by the analysis, is a magnesic-saline calcic water. The Gypsum Spring is quite a strong muriated and sulphureted saline calcic. Both of these springs are cathartic in their action. The Hot Spring is a muriated saline.

One of the most extraordinary and, perhaps, least known wonders of Arizona is Las Tinajas (The Basins), about thirty miles southeast of Mission Camp, between Yuma and Sonora. The mountains here have one face of smooth, hard granite. All the water falling upon the lower basin, has first to flow through nine tanks, one above the other. The lower tanks are of easy access, and are often drained of their contents by wild and domestic animals and by travellers; the upper ones are approached only by circuitous and difficult climbing over smooth and treacherous rocks. To one standing below these upper basins afford no indication of their existence, nor does the steep mountain side seem possible of ascent. The rains are frequent high up in the mountains at various times of the year, and are generally accompanied by furious winds; thus, whirling torrents are poured into the upper tanks, washing them out completely, leaving no organic substance whatever behind. These waters then filter through the bottoms of the upper tanks into the lower ones, and are as clear as crystal when they reach their final precipitation. "To these lower tanks, which contain water, go antelopes, mountain sheep, deers, rabbits, hares, foxes, and coyotes, while tens of thousands of birds seek the upper ones, the din of their song and chatter being almost deafening."

ARKANSAS.

This State extends from 33° to 36° 30′ north latitude, and from 80° 32′ to 94° 38′ west longitude.

The principal rivers are the Mississippi, which washes the eastern shore for a distance of four hundred miles; the Arkansas, which intersects the State from east to west; the White, the Red, and the San Francisco Rivers.

A considerable portion of southern Arkansas is covered by pine forests; oak, maple, and hickory predominate in the hilly portions of the State, and the large rivers are fringed with broad belts of cottonwood, cypress, and gum trees.

The climate of Arkansas is mild, the mean annual temperature in the northern part being about 58°, in the central 61°, and in the southern portion 64°. The northwestern part is the coldest, and the southeastern the warmest.

The eastern part of the State bordering on the Mississippi is low and swampy, and is annually overflowed. Westward the country gradually attains a greater elevation, passing off into the hills and undulating prairies which lead up to the Ozark Mountains, beyond which an elevated plain stretches toward the Rocky Mountains. The rainfall varies from 54 inches in the southeast to 40 inches in the northwest.

The United States Census returns indicate a mortality rate of 12.76 per 1000. The mortality from phthisis is 1.07 per 1000 of the population.

The famous Hot Springs have given Arkansas much importance as a mineral spring State. There are several other important spring localities and numerous smaller ones of minor importance. Of the springs whose general character is known probably half are chalybeate, and nearly that number are also sulphureted. The following account is based on personal investigation by the author in various portions of the State.

ARKANSAS LITHIA SPRINGS,

HEMPSTEAD COUNTY.

Post-office, Hope. Cabins and farm-houses in neighborhood. Access *via* Iron Mountain R. R. to Hope, thence by private conveyance five miles to Springs.

The location is in a picturesque rolling region and is about 800 feet above the sea-level. The springs, two in number, have been used by the country people for some years past, but have only recently attracted attention beyond the neighborhood. The following analysis was made by Prof. Muehler:

ARKANSAS LITHIA SPRINGS.

Saline-chalybeate. Lithic.

One U. S. gallon contains:	Grains.
Magnesium sulphate	10.74
Calcium sulphate	11.66
Strontium sulphate	1.39
Lithium carbonate	6.35
Sodium chloride	20 23
Potassium chloride	4.04
Magnesium chloride	0.42
Iron oxide	12.34
Magnesium iodide	1.66
Magnesium borate	0.08
Iron crenate	0.11
Silica	3.37
Alumina	0.92
Total	73.21

The analysis shows an unusual richness in mineral ingredients. The water may be ranked as a strong chalybeate with saline and lithic properties. It is a pleasant aperient, and has decided diuretic, tonic, and alterative properties. The physicians of the neighborhood have long recommended it in cases of gravel, cystitis, kidney troubles, indigestion, and torpidity of the liver. The water is bottled and used commercially. It is probable that a first-class resort will be established in the neighborhood of the springs.

DOVE-PARK SPRINGS,

HOT SPRINGS COUNTY.

Post-office, Dove Park. Hotel and private houses. These springs are located three miles from Dove-Park, at an elevation of 295 feet above the sea-level. They are twelve in number, and yield a flow of about 2160 gallons per hour. The water has a temperature of 62° F. No analysis seems to have been made. We are informed that the water has acquired quite a celebrity in the treatment of dropsical affections due to kidney disorders, and in rheumatism and dyspepsia, and locally in cases of chronic conjunctivitis, leucorrhœa, etc.

According to the latest United States Geological Reports,[1] the water is used commercially.

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[1] Extract from the Seventeenth Annual Report of the United States Geological Survey, 1895–96.

EUREKA SPRINGS,

CARROLL COUNTY.

Post-office, Eureka Springs. Hotels: Crescent and Southern, and numerous smaller houses. Access *via* Eureka Springs branch of the St. Louis and San Francisco R. R.

The development of Eureka Springs affords a forcible object lesson of the progress of civilization in the Western wilds of America. Where a few years ago (1879) was an uninhabited, sterile mountain glen, now nestles a bright little city of more than 6000 inhabitans, which number is greatly increased by the large floating population of visitors, tourists, business men, and invalids constantly coming and going. The city is lighted by gas and electricity, contains an electric railway system, and excellent schools, hotels, etc. The Interstate Summer Normal and Educational Assembly have erected a building with a seating capacity of 5000 persons, in which annual summer sessions are held and attended by visitors from all parts of the Union. The State District Normal School of Arkansas is also located here.

The springs are sixty in number; the best known being as follows: The "Crescent," "Dairy," "Basin," "Magnetic," "Harding," "Little Eureka," "Sweet," "Grotto," "Mystic," "Oil," "Arsenic," "Cave," and "Cold" Springs. The waters contain mainly carbonates of lime and magnesia with a small proportion of sulphates and chlorides. They are not strongly mineralized, and differ but slightly from each other.

The following table from the report of F. W. Clarke, Chief of the Division of Chemistry, United States Geological Survey, and R. R. Riggs,[1] shows the proportion of solids in four of the principal springs:

Crescent Spring	5.36	grains per U. S. gallon.
Dairy Spring	6.29	" " "
Basin Spring	6.97	" " "
Magnetic Spring . . .	10.99	" " "

The following table, sent us by Dr. John D. Jordan, of Eureka Springs, shows some of the climatic advantages of the resort:

Eureka Springs.	Altitude above sea level, 2000 feet.		
	Annual average precipitation . .		32.79
	Mean temperature .	Spring,	60.85°
		Summer,	74.79°
		Autumn,	58.01°
		Winter,	42.08°
	Annual average		58.93°
	Relative humidity (per cent.) .		58.93
	Average No. days per annum .	Clear weather,	209
		Fair "	90
		Cloudy "	66

Death-rate per annum, 10.33 per 1000.

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[1] February 15, 1877.

The city is picturesquely located on the headwaters of the White River in the Ozark Mountains. A sojourn at Eureka Springs and the free use of its waters are stated to be beneficial in a wide range of affections, including rheumatism, skin, nervous, renal, and bladder disorders, dyspepsia, hay-fever, and general debility.

HOT SPRINGS,

GARLAND COUNTY.

Post-office, Hot Springs. Hotels: Arlington, Eastman, Pullman, Avenue, Park, Bloomington, Josephine, etc. According to Cutler's *Guide to the Hot Springs*, there are as many as 500 hotels and boarding-houses in the city. Access *via* the Iron Mountain Route, the only line running to the Hot Springs. All lines leading into St. Louis connect in the Grand Union Depot with express trains of the Iron Mountain Route. From the South the best route is *via* Cairo, Columbus, Memphis, or Texarkana, connections being made at each of these points with Iron Mountain express trains.

The Springs are fifty-five miles southwest of Little Rock, the State capital, and twenty-two miles from Malvern, where trains on the Iron Mountain connect with Hot Springs R. R. leading directly to the Springs. Sleepers come through without change at Malvern.

The Hot Springs are situated on the Mountain Creek and in the valley of the same name. They issue from the western slope of the Hot Springs Mountain, a spur of the Ozarks, at an elevation of 700 to 800 feet above the Gulf of Mexico. The mountains on either side attain an altitude of 1200 feet. The climate in this region, as a general rule, is mild and balmy and not subject to extremes of either heat or cold. Sunstroke is unknown, and the summer nights are generally cool and pleasant, light blankets, as a rule, being required before morning. The pure mountain air and constant southerly breezes unite in forming a healthful and invigorating climate. The lowest temperature observed in 1891 was 16° F., the highest 98° F., the average for that year being 84° F., or somewhat higher than the average for a series of preceding years. The rainfall for 1891 was 70.86 inches.

These springs have been known and utilized as a health resort since early in the century. During that time they have acquired a world-wide reputation in the treatment of certain diseases. A city of considerable size and containing numerous excellent hotels, sanitariums, bathing-houses, and public buildings has been developed about them. Some of the handsomer and more commodious bath-houses were erected at a cost of from $10,000 to $50,000. Among the more prominent of these are the Eastman, Park, Alhambra, Superior, Palace, Magnesia, Ozark, Horseshoe, Rammelsburger, Lamar, and Maurice pavilions. The discharge of water from the springs amounts to 335 gallons per minute, or 482,000 gallons per day. These waters are nearly all concentrated in large air-tight tanks, built by the United States Government, and are sufficient to bathe 19,296 persons daily, allowing twenty-five gallons for each bath. The springs are now seventy-two in number, another having recently been added to the list, according to a late annual report of the local Board of Health.

From the United States Engineer's Report to the Hot Springs Commissioners we obtain the following table of temperatures of the springs:

No.	Temp.	No.	Temp.	No.	Temp.
1	77°	25	111°	49	131°
2	76	26	106	50	145
3	124	27	127.5	51	144
4	124	28	145	52	143
5	80	29	80	53	144.5
6	103	30	134.5	54	146
7	115	31	147	55	122
8	121.5	32	124	56	133
9	122	33	140	57	128
10	121.5	34	120	58	Sipage.
11	105	35	135	59	133
12	111	36	110	60	134.5
13	135.5	37	120	61	135
14	137	38	128	62	109
15	134	39	125.5	63	83
16	131	40	112	64	135
17	Sipage.	41	157	65	141
18	93	42	Sipage.	66	87
19	84	43	144	67	Sipage.
20	83	44	Sipage.	68	131
21	106	45	111	69	83
22	122	46	Sipage.	70	89
23	125	47	144.5	71	94
24	113	48	91		

Highest temperature, 157°; lowest, 76°.

Those marked "sipage" are intermittent. All others are constant and unvarying in heat and quantity. All the springs on the east side of Hot Springs Creek flowing from Hot Springs Mountain, except one under the Rammelsburger bath-house, are hot. All on the west side, except the alum spring, are cold. No complete analysis of the waters seems to have been made since the now somewhat antiquated one of Prof. E. Hills Larkin in 1859. It is as follows:

ARKANSAS HOT SPRINGS.

Light alkaline-calcic. Thermal.

One U. S. gallon contains:	Grains.
Magnesium carbonate	0.13
Calcium carbonate	3.97
Sodium sulphate	0 38
Potassium sulphate	0.23
Calcium sulphate	0.11
Sodium chloride	0.01
Calcium silicate	0.46
Sodium	Trace.
Bromium	Trace.
Iron sesquioxide	0.10
Alumina	0.45
Silica	1.87
Organic matter	0.70
Water (?)	0.14
Total	8.55

The water also contains a considerable quantity of free carbonic acid. Persons taking the baths here should always do so under the supervision of one of the local physicians. Those affected with organic disease of the heart or recognizable physical signs of consumption are not allowed to bathe, as the thermal action of the water is liable to be prejudicial to such cases. If the lungs are but slightly involved, careful bathing may be permitted. Furthermore, cases of simple cardiac palpitation are not excluded. As each case must be treated on its merits, and as detailed instructions are given by the local physician, it is unnecessary here to enter into a minute description of the bathing process at Hot Springs. Suffice it to say that patients are usually (not invariably) required to bathe six minutes in water at 96° to 100° F., two to six minutes in the vapor bath-rooms, and five to twenty minutes in blankets, according to the time required to induce perspiration. The course here has been found especially beneficial in diseases of the genito-urinary system, especially syphilis, and in gout, rheumatism, and neuralgia. The baths are also recommended on high authority in various skin affections, including eczema, psoriasis, urticaria, impetigo, prurigo, rupia, etc.

The city of Hot Springs itself is well drained and well lighted, and has ample police and fire protection. It now claims a population, resident and visiting, of 21,000. About 50,000 persons visit the place annually, and this number is ever on the increase. The United States Government Army and Navy Hospital, recently erected, cost $200,000. It is said that the Arlington Hotel, with its bath-house attached, will have cost over $500,000 when completed.

Among other mineral springs within the limits of the city of Hot Springs, or in the neighborhood, are the following:

ALLEN'S ALTERATIVE SPRING.

This spring is situated on Central Avenue, in the heart of the city. The following is a copy of a qualitative analysis made by Prof. C. B. Gannaway:

Magnesia.
Soda.
Silicic acid.
Chlorine.
Free carbonic acid.
Lime.
Alumina.
Sulphuric acid.
Organic matter.

Temperature of water, 59° F.

The water is recommended to persons in a debilitated state, especially those suffering from stomach, kidney, bladder, or liver troubles.

GILLEN'S WHITE SULPHUR SPRINGS.

These are located three miles from Hot Springs. Stage runs daily from Hot Springs, making the trip in forty minutes. According to an analysis by Chauvenet and Blair, of St. Louis, the water contains carbonate of iron, lime, and magnesia, traces of organic matter, and very small quantities of sulphuric acid and free carbonic acid. No sulphureted hydrogen was found. The total residue on evaporation is 16 grains to the gallon. The waters are recommended by Hot Springs physicians in conjunction with baths at that resort. They are said to be useful in some of the disorders affecting the stomach, liver, bladder, and kidneys. The new hotel at Gillen's Springs is known as the Victoria. It is beautifully situated in a shady park, and surrounded by mountain scenery well worthy of the artist's attention.

MOUNTAIN VALLEY SPRINGS.

These valuable springs are situated twelve miles north of Hot Springs, at the foot of Blakely Mountain. The location is in a beautiful valley extending well up into the mountain range. According to Chauvenet and Blair, the composition of the water is practically identical with that of Gillen's White Sulphur Springs. The high degree of purity of the water gives it extraordinary keeping qualities, and it is extensively sold for use on the table and bar, as well as in the sick-room. It is recommended for diabetes, general debility, and for various affections of the liver, stomach, bladder, and kidneys. A hack line runs to and from the Hot Springs.

POTASH SULPHUR SPRINGS.

Post-office, Lawrence. Hotel. These springs are located seven miles east of Hot Springs on the Hot Springs R. R., one mile from Lawrence Station. Hacks meet all trains during the season.

The country about these springs is broken and mountainous, and very picturesque. The altitude of the location is between 600 and 700 feet above the Gulf level. The meteorological conditions are about the same as those prevailing at Hot Springs. The springs are four in number and flow about 600 gallons per day. The temperature of the water is about 62° F. No complete analysis seems to have been made, but according to a partial examination by Dr. John C. Branner, State Geologist, the chief ingredients are the sulphate and carbonate of sodium and the chloride of potassium, the sodium salts amounting to 13.66 grains per gallon, and the potassium to 3.51. One of the springs contains 66 grains of solid matter to the gallon; another 49.68, and a third 31.02. The waters are highly recommended in digestive and urinary complaints. It is said that of the more than 12,000 visitors to the springs in 1892 the average increase in the weight of each person the first week was more than four pounds. The waters are used commercially.

RAVENDEN SPRINGS,

RANDOLPH COUNTY.

Post-office, Ravenden Springs. Hotel Southern and numerous smaller hotels and inns. Access *via* Kansas City, Fort Scott, and Memphis R. R. to Ravenden Station, thence five miles by coach or hack to Springs.

This resort is located in the northern part of Arkansas near the White River Mountains, the range in which the Eureka Springs have their origin. The elevation is 1200 feet. The geological formation is the same as that at Eureka, but the mountains are not so high or rugged. The surrounding scenery is, however, exceedingly fine, and many features of interest are pointed out to visitors. The place takes its name from the "Ravens' Den," a small cave with a circular opening a few feet from the top of the highest mountain. In this cave it is said that many of the feathered denizens of the forest, particularly the raven, or black crow, made their homes and hatched their young for a long period of time. Fish and game are abundant in this vicinity, and it is stated that many deer are killed close by during the winter months. The following analysis of the water was made by Messrs. Wright and Merrill, analytical chemists of St. Louis, in 1885:

RAVENDEN SPRINGS.

Alkaline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Lithium carbonate	1.26
Calcium carbonate	4.61
Magnesium carbonate	4.48

One U S. gallon contains:

Solids.	Grains.
Calcium chloride	1.24
Magnesium chloride	2.99
Sodium chloride	2.19
Alumina	2.36
Calcium sulphate	Trace.
Silica	0.83
Iodine and iron, of each a trace.	
Organic matter	1.86
Total	21.82

Gases.	Carbonic acid	21.5 cubic inches.
	Atmospheric air	13.3 " "

Temperature of water, 59° F.

SULPHUR SPRINGS,

Benton County.

Post-office, Sulphur Springs. Four hotels. Access *via* Kansas City, Pittsburg, and Gulf R. R. The springs are located in a mountainous region 1100 feet above the sea-level. A qualitative analysis of the water by G. Belknap, M.D., analytical chemist, shows the presence of the following ingredients:

Sodium chloride.
Sodium carbonate.
Iron sulphate (traces).
Magnesium carbonate (large quantities).
Sulphureted hydrogen gas.

The water has valuable antacid and tonic properties. It is bottled and sold.

Among other springs resorts in Arkansas are the following: Blanchard Springs, Union County; Blanco Springs, Hot Springs County; Lee's Springs, Jefferson County; Mount Nebo Springs, Gill County; Pennywit's Sulphur Springs, Crawford County; Searcy Springs, White County, and Warm Springs, Randolph County.

CALIFORNIA.

California is the second State in size in the Union. It extends from 32° 34′ to 42° north latitude, and from 114° 8′ to 124° 24′ west longitude, and comprises an area of 188,981 square miles. The State is naturally divided into four distinct regions, viz., (1) the Coast Range, (2) the Sierra Nevada, (3) the Central Valley, (4) the Southwestern Region. California has but two large rivers, the Sacramento and the San Joaquin, which traverse the Grand Central Valley in opposite directions and empty into Suisun Bay. The Klamath, the Salinas, and other smaller streams also assist in draining the State. The climate of California varies considerably in different portions, the mean annual temperature in the north being below 50° F., while in the southeastern portion it exceeds 70° F. The mean annual temperature at San Francisco for a period of eleven years was 55.23°, and at Fort Yuma, for a corresponding period, 74.77°. In San Francisco rain falls freely during November and December, and the hottest months are September, October, August, and July, in the order mentioned. The interior of the State, not being influenced by the sea, has a continental climate, and the greater the distance from the ocean the colder the nights and the warmer the days. The average rainfall increases from south to north, and in the Sierra Nevada with the altitude; at Fort Yuma it is but four inches; at San Diego, 9.16; in Sacramento, 19.56; in San Francisco, 21.69, and in the Sierras at an altitude of 5000 feet, 45 inches or more.

California has well been called the garden of the world, for, embracing as it does every kind of soil and climate, it yields all the products of the temperate and many of those of the tropical and semi-tropical regions. The Sierras and the Coast Mountains constitute the most prominent geographical and topographical features of California. The former inosculates with the coast ranges at its two extremities, the Tejon Pass in the south, and Mount Shasta in the north. In these localities the two systems are so linked that the distinction between them becomes a geological and not a geographical one. The mortality rate in California by the latest United States Census returns was 14.65 per 1000; consumption mortality, 2.39 per 100 of population, or 163.19 per 1000 of the total deaths.

California possesses a greater number of mineral springs than any other State of the Union, East or West. Peale's list mentions 325 localities, and this still leaves several unaccounted for. The springs embrace all types of mineral waters. Naturally many of them are thermal, for the volcanic rocks with which such springs are usually associated are found in many portions of the State. The recent treatise of Dr. Winslow Anderson[1] has brought many of the California Spring resorts into prominence. The analyses show that some of the waters compare favorably with the most celebrated springs of Europe. Many of them are put up for sale and shipment. The following account of the California springs is based largely on Dr. Anderson's work, supplemented by various geological reports and by correspondence with all sections of the State.

ADAMS SPRINGS,

LAKE COUNTY.

These picturesque springs are located two miles from Coob's Valley and eight miles south of Clear Lake. They are reached by the train which goes by way of Oakland Pier, Vallejo, and Calistoga. From the last point a stage is taken, which carries one along a pleasant mountain road hedged in on either side by manzanita copses, scrub oaks, and, toward the summit, fragrant redwood trees. The resort itself lies among rolling hills, which are thickly shrouded in verdant loveliness a greater part of the year. Beyond these hills lie the larger mountains of the Coast Range, covered to the summits with their heavy growth of redwood and pine. Fogs are rare in Lake County, and the air is uniformly dry and pure, resembling that of Nice in the south of France. The elevation of the springs is 3300 feet above the sea level. Commodious quarters have been prepared for guests. The following analysis of the main spring was made in 1888 by Dr. Anderson:

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[1] The Mineral Springs and Health Resorts of California, San Francisco, 1892.

ADAMS SPRINGS, LAKE COUNTY.

Alkaline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	4.64
Sodium bicarbonate	8.07
Sodium carbonate	50.07
Potassium salts	Traces.
Magnesium carbonate	97.90
Magnesium sulphate	Traces.
Calcium carbonate	27.95
Calcium sulphate	1.36
Ferrous carbonate	0 55
Silica	7.42
Alumina	Traces.
Organic matter	2 60
Total	201 19

Free carbonic acid gas, 265.76 cubic inches.

An older analysis, by Prof. Price and Mr. Hewston, shows results practically identical with the above. The water is cool and sparkling and belongs to the alkaline-calcic-carbonated class. It is said to be highly recuperative to persons suffering from chronic dyspepsia and portal congestion. It is also used for rheumatism, and is said to be very efficacious in chronic Bright's disease ; chronic uterine inflammation has also been benefited. Bathing facilities have been provided, and the springs are enjoying an increasing patronage from year to year.

ÆTNA SPRINGS,

NAPA COUNTY.

Hotels and cottages. Location, at the upper end of Pape Valley, sixteen miles northeast from the town of St. Helena. Access by rail *via* Napa to St. Helena, and thence by stage or carriage over a well-graded picturesque road. The springs are pleasantly situated at an elevation of 1000 feet above the Pacific in the midst of wild mountain surroundings. The atmosphere is delightfully dry and bracing. The mountains in the vicinity are well stocked with wild game, and the streams afford good fishing. The temperature of the two principal springs used for drinking purposes is 98° F. The waters are sparkling, invigorating, and tonic, and slightly aperient. There are also springs having a temperature of 106° F., which are largely used for bathing, ample facilities having been provided for that purpose. Several other springs whose waters have not been analyzed are similar in composition, with the addition of more iron. These are known as the "Iron Soda" Springs, and are much used for anæmia and wasting affections. The following analysis of the Ætna Soda Springs was made by Dr. Winslow Anderson in 1888:

ÆTNA SODA SPRINGS.

Alkaline-saline. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	28.75
Sodium carbonate	73.06
Sodium sulphate	8.92
Potassium sulphate	0.56
Potassium carbonate	13.23
Magnesium sulphate	0.45
Calcium carbonate	8.94
Ferrous carbonate	0.05
Silica	0.09
Organic matter	Trace.
Total	134.05

Gases: carbonic acid, 63 cubic inches.

An analysis by J. H. Bauer, of San Francisco, ten years earlier, shows results but slightly differing from the above. These waters resemble those of Ems to quite a marked degree. They are a good type of alkaline-saline water. The Ætna Springs are rapidly gaining in public favor, and have already acquired considerable reputation in cases of renal affection, so frequent on the coast. Beneficial results are also reported in rheumatism and neuralgia, as well as in dyspepsia, torpidity of the bowels, and in hepatic and uterine derangement.

AGUAS CALIENTES.

In the southern part of the State are situated a number of thermal springs, known as *aguas calientes* (hot waters). Some of them have acquired considerable celebrity. This is especially true of the springs in Coahuila or Cabajos Valley, some ten miles south of White River, on Warner's Ranch, fifty miles from San Diego

City, in San Diego County. These waters are believed among the native population to be an infallible remedy in syphilis and cutaneous affections. They vary in temperature from 58° to 142° F. The water boils up from a granite ledge through a number of openings or cleavage fissures. It flows copiously, giving a volume of about a two-inch pipe under two foot-pressure. Bubbles of sulphureted hydrogen and steam issue forth with considerable force, producing the characteristic smell of sulphur and clouds of vapor. At one place a small geyser has developed, emitting steam and water with a hissing sound. Incrustations of crystallized sulphur are deposited on the surrounding rock (Blake). The waters possess a sulphurous and not unpleasant acid taste, and are much used for drinking and bathing purposes. Accommodations for visitors have been provided. These hot sulphurous waters are highly recommended by those who have been there and used the baths and taken the waters. The diseases treated most frequently are rheumatism, subacute and chronic, syphilitic contaminations and strumous diseases, cutaneous affections, and renal and hepatic engorgement. The analysis is by Oscar Loew:

AGUAS CALIENTES.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	8.30
Sodium sulphate	Trace.
Sodium chloride	31.00
Calcium	Trace.
Magnesium	"
Lithium	"
Silica	"
Hydrosulphuric acid	"
Organic matter	"
Total	39.30

Gases not given.

There is another agua caliente of some repute, thirty miles from Caliente Station, on the Southern Pacific R. R. line, in Keon County. The waters are sulphureted, and their temperature varies from 80° to 100° F. There is a small resort at the springs, but no analysis has been made.

AGUA DE VIDA SPRINGS.

These are located in Arroya Mucho, among the foot-hills of Cedar Mountain, southeast of Livermore, and at an elevation of 1700 feet. The route of travel is by way of the Central Pacific R. R. to Livermore, and thence by carriage a few miles to the Springs. The location is three hours' ride from San Francisco.

Extensive improvements have been made on the grounds, consisting of a magnificent hotel surrounded by commodious family cottages. The grounds, which are naturally picturesque, will be still further beautified by the construction of broad driveways, rustic bridges, cool arbors, and other desirable features. There are a number of mineral waters in the place, both carbonated and sulphureted. The lower drinking spring is of light carbonated water, which is clear, sparkling, and extremely palatable. In action it is tonic, antacid, diuretic, and aperient. The following analysis was made by Dr. Anderson in 1888:

AGUA DE VIDA (LOWER SPRING).

Alkaline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	4.02
Sodium carbonate	3.65
Sodium sulphate	14.73
Potassium carbonate	0.55
Magnesium carbonate	7.95
Magnesium sulphate	0.46
Calcium carbonate	13.75
Calcium sulphate	0.10
Alumina	0.37
Silica	0.42
Organic matter	Trace.
Total solids	46.00

Carbonic acid gas, 19.25 cubic inches.

This water is an excellent antacid in dyspepsia of certain types. It is also recommended in congestion of the kidneys, cystitis, etc. The upper or larger spring is mildly sulphurous, saline, and laxative. It was analyzed by Dr. Anderson in 1889, with the following results:

AGUA DE VIDA (UPPER SPRING).

Alkaline-saline. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	5.07
Sodium carbonate	2.25
Sodium sulphate	17.50
Potassium carbonate	Trace.
Magnesium carbonate	3 19
Magnesium sulphate	8.70
Calcium carbonate	11.92
Calcium sulphate	4.35
Manganese carbonate	Traces.
Alumina	0.40
Silica	0.55
Organic matter	Traces.
Total solids	53.93

Gases.	Cubic inches.
Sulphureted hydrogen	2.74
Carbonic acid gas	9.25

Temperature, 57.5° F.

ALLEN SPRINGS,

LAKE COUNTY.

These valuable springs are situated three miles east of Bartlett Springs, and some forty miles west of the town of Williams, in the Coast Range Mountains. The location is in a canyon at the head of Cache Creek, and the altitude is 1800 feet above tide-water. The resort and springs are delightfully shaded by huge oaks and towering pines and surmounted by evergreen hills. The climate is genial and salubrious, the atmosphere bracing and invigorating, and the evening air cool and pleasant. There is good hunting and fishing near by. There are three alkaline and two ferruginous springs on the place; all are cool and sparkling and delightfully aërated with carbonic anhydride. The soda spring makes a delicious drink, which may be improved by adding a little syrup. Dr. Anderson's analysis (1888) shows the following results:

ALLEN SPRINGS.

Alkaline-saline. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	23.16
Sodium bicarbonate	4 25
Sodium sulphate	0.78
Potassium chloride	1.90
Magnesium bicarbonate	27.40
Potassium bicarbonate	0.75
Magnesium chloride	63 00
Calcium bicarbonate	20.14
Calcium phosphate	0 55
Ferrous carbonate	0.93
Organic matter	Trace.
Total	142 86

Carbonic acid gas, 36 cubic inches.

Prof. Wenzell's qualitative analysis also shows the presence of silica. The waters are gently aperient, and have gained considerable reputation in chronic hepatic and renal affections associated with dropsy. Dyspepsia, chronic constipation, and chronic malarial disorders are also benefited. The resort has ample accommodations for guests, beside good bathing facilities. The grounds are well adapted for camping. Samples of other springs on examination showed larger amounts of iron and less of magnesia and soda, and were also less strongly aërated.

ALUM ROCK SPRINGS,

Santa Clara County.

Hotel. These springs are situated on the western slope of the Coast Range, about seven miles northeast of San José. The location is in a romantic canyon with a most unromantic name—Penitentiary Canyon—so called in consequence of the early Jesuits on the coast assembling there to do penance. The drive to San José is one of unusual grandeur, presenting an ever-varying scene of ruggedness and natural beauty. The canyon is densely wooded, and the almost perpendicular cliffs shade the carriage drive, making it delightfully cool and pleasant, even in the hottest part of the day. The nearness of the springs to San José, and the excellent accommodations offered at the hotel, with the many natural advantages in consequence of the lovely Garden City climate, and the mineral waters, make Alum Rock Springs a favorite resort for tourists, summer visitors, and invalids. The summer temperature is rarely above 90° F., and in the winter it is never too low for comfort. Trout and mountain quail abound, affording good sport for rod and gun.

There are several springs in activity at Alum Rock. The principal "soda" or drinking-water spring was found by Dr. Anderson to contain the following ingredients:

ALUM ROCK SPRING.

Alkaline-saline. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	7.14
Sodium chloride	10.21
Potassium carbonate	0.76
Magnesium carbonate	8.92
Magnesium sulphate	7.16
Calcium carbonate	19.05
Manganese carbonate	Trace.
Ferrous carbonate	"
Alumina	6.45
Silica	2.52
Total	62.21

Free carbonic acid gas, excess.

The chalybeate spring was analyzed by Prof. Hatch, with the following results:

One U. S. gallon contains:

Solids.	Grains.
Ferrous oxide	0 30
Alumina	0.15
Manganese	0.70
Soda	3.40

One U. S. gallon contains:

Solids.	Grains.
Potassa	0.20
Chlorine	1.60
Hydrosulphuric acid	3.30
Total solids	9.65[1]

There are also two thermal sulphur springs having a temperature of 85° F. These are used for bathing purposes. Alum Rock Springs have gained considerable reputation in the treatment of anæmia, chlorosis, chronic malaria, nervous prostration, and debility. They ought, furthermore, to be useful in the hemorrhagic diathesis, menorrhagia, etc., on account of the iron, alum, and acids the water contains.

ANDERSON MINERAL SPRINGS,

Lake County.

Hotel and cottages. Location, nineteen miles from Calistoga, five miles from Middletown, and ten miles from the Great Geysers. They are easily reached by stage from the railroad termini, Calistoga, and Cloverdale. The mountain roads are well kept, and the stage ride is one of the most picturesque in the State. The ever-changing picture of hill and dale, forest and shrubbery, brooks with ferns and mosses, all combine to produce one of those pleasing panoramas which the witness loves to recall to mind in after days.

The springs and resort are located in a cosey nook in a small canyon surrounded by forests and picturesque waterfalls. The atmosphere is balmy and exhilarating and free from humidity.

The worshipper at Nature's shrine, the lover of grand and varied scenery, will find all that can be desired at the Anderson Mineral Springs. "The perennial mountain streams that softly murmur past the cottages, the bright waters gliding over mossy banks and beds of pebbles, breaking into showers of sparkling diamonds, the caves, the cascades, and waterfalls; the cool, leafy dells, the profound silence and solitude of the dense forests, where one might almost expect to surprise Pan and his pipes—all, in the glittering moonlight, or brighter rays of old Sol, make a picture that only the pen of a Thoreau could describe or the pencil of a Bierstadt display."

Fish and game abound all the year round. The hotel and cottages afford excellent accommodations, and invalids and pleasure seekers come by the thousand to enjoy the many advantages of the spot. There are nine principal springs. The main drinking spring is the "Cold Sulphur," located about 150 yards from the hotel. Following is the result of Anderson's analysis:

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[1] It is well to mention that in this analysis the salts and elements are reduced to an anhydrous state. The same analysis with the water of crystallization would probably yield a residue weighing several times more.

COLD SULPHUR SPRING (ANDERSON'S SPRINGS).

Saline. Sulpho-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	1.09
Sodium carbonate	9.27
Sodium sulphate	6.18
Potassium salts	Traces.
Magnesium carbonate	11.73
Magnesium sulphate	16.95
Calcium carbonate	20.40
Calcium sulphate	9.10
Ferrous carbonate	0.46
Arsenious salts	Traces.
Silica	2.45
Organic matter	Traces.
Total solids	77.63

Gases.	Cubic inches.
Carbonic acid gas	243.50
Sulphureted hydrogen	4.20

This is a saline and mildly sulphureted water, and very useful in chronic skin diseases of strumous and syphilitic origin. In liver and bowel troubles, glandular congestions, and in uterine and ovarian engorgement, the water has also been found of much value. It is aperient, diuretic, and alterative in its action.

Another valuable water is the "Iron Spring." The following analysis was made by Mr. George E. Colby, of the University of California, in 1889:

IRON SPRING (ANDERSON'S SPRINGS).

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.18
Sodium bicarbonate	0.19
Sodium sulphate	3 42
Potassium sulphate	1.17
Magnesium sulphate	7.35
Calcium sulphate	10.88
Calcium phosphate	0.15
Ferrous carbonate	1.18
Alumina	0.93
Boric acid (with spectroscope)	Strong test.
Lithium (with spectroscope)	Well-marked test.
Manganous carbonate	1.77
Silica	4.22
Organic matter	Small quantity.
Total solids	31.45

Free carbonic acid gas, 25.80 cubic inches.
Temperature of water, 124° F.

The action of this water is tonic and laxative, and valuable in anæmia, chlorosis, and diseases requiring recuperative agents.

The "Sour Spring" is one of the few California mineral springs containing free sulphuric acid. Its sour taste was supposed to be due to alum, but the following analysis by Mr. George E. Colby (1889) shows that no alum is present:

SOUR SPRING (ANDERSON'S SPRINGS).

Sulphated-saline. Acid.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.08
Sodium sulphate	0.49
Potassium sulphate	0.87
Magnesium sulphate	4.76
Calcium sulphate	2.07
Ferric sulphate	0.63
Aluminum sulphate[1]	7.11
Boric acid (with spectroscope)	Strong test.
Lithium (with spectroscope)	Well-marked test.
Ammonia (manganous sulphate)	0.33
Silica	3.94
Organic matter	Traces.
Total	20 28

A considerable quantity of free sulphuric acid was also revealed by the analysis. The temperature of the water is 64.3° F.

The Sour Spring waters have proved very beneficial in hemorrhages of the lungs, menorrhagia, dyspepsia, etc. They are tonic, astringent, and gently laxative.

Among other valuable springs in the Anderson group are the "Belmar" spring, a light saline sulphur water; the "Magnesia," or "Father Joseph's" spring, a rich saline water with valuable laxative properties; the "Cosmopolitan," an excellent drinking water, with laxative effects, and the "Hot Sulphurous," or "Bathing" spring. These last waters have a temperature of 145.5° F., and are very beneficial in rheumatism, chronic joint swellings, and skin diseases. There are good facilities for bathing. It is claimed that the inhalation of the hot sulphurous steam of this water is highly useful in cases of chronic bronchitis, incipient phthisis, and catarrhal affections of the nose and throat. On the rocks over the hot sulphurous and vapor springs are deposited incrustations of the vaporized minerals. These are collected and powdered and used as a snuff in cases of chronic nasal catarrh. It is said to produce very desirable results, and even in acute coryza and colds in the throat it has a grateful effect, often shortening the attack. All the mineral ingredients contained in the waters are found in this spring.

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[1] A microscopical examination of the residue obtained by slow evaporation fails to show characteristic crystals of alum.

ARROW-HEAD HOT SPRINGS,

San Bernardino County.

Post-office, Arrow-head Springs. Hotel. Access by stage from San Bernardino, six and a half miles distant to the south. Parties leaving Los Angeles, sixty-seven miles distant, should take the 8.30 or 11 A.M. or 12.20 P.M. Santa Fé train, or the 7.45 or 8.30 A.M. train on the Southern Pacific line.

These springs burst from the mountain slope of the Sierra Madre, 2000 feet above the level of the sea, and 1000 feet above the foot of the mountain. A bench-like mesa, containing 100 acres, projects at this point from the mountain, and is bounded on the east and on the west by two enormous canyons. Down the deep ravine or canyon on the east comes a mountain stream of water as cold as ice, while in the canyon on the west flows a stream formed by the boiling springs, so hot that it fills the air with steam and sulphurous gas.

The Arrow-head Hotel is located near the springs, on the plateau of land between the two canyons. It is an elegant modern structure with ample room for 150 guests. Every room is lighted by electricity, and the halls and larger rooms are heated by hot water from the springs, conducted in iron pipes.

The Arrow-head Springs were known to the Indians long before the settlement of the country by the pale-faces, and were resorted to by them from far and near. On the face of the mountain back of the hotel is the figure of an arrow-head, 1360 feet long and 450 feet wide, supposed to have been executed by the Indians. The figure gives its name to the resort, and so perfect is its contour and so elevated its situation that it can be seen from almost every part of the valley, and stands as a prominent landmark for miles around.

The meteorological conditions are similar to those usually prevailing in Southern California, the weather being, as a rule, clear, balmy, and bright. The extreme temperature-records have been 100° F. high, and 34° F. low. The winter season is most favorable for visiting the springs. These are thirty-seven in number, the aggregate flow of water being equal to ten miners' inches. The following is an analysis of one of the springs by Prof. E. W. Hilgard, of the State University:

ARROW-HEAD HOT SPRINGS.

Sulphated-saline.

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	4.00
Sodium sulphate	42.48
Sodium chloride	8.18
Lithium	Strong test.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	1.34
Calcium carbonate	1.34
Barium	Faint test.
Strontium	Well-marked.
Magnesium sulphate	0.15
Magnesium carbonate	0.32
Silica	4.94
Organic matter	Trace.
Total solids	63.39

Free sulphureted hydrogen, 0.64 cubic inches.
Temperature of water, 193° F.

The analysis shows a considerable resemblance to the Carlsbad waters. The water is soft, clear, and pleasant to drink, and is said to eliminate malarial and miasmatic poisons from the system when taken internally. The waters owe their wide reputation, however, to their beneficial effects when used for bathing purposes. They are given in the form of vapor, hot mineral water, and mud baths. These baths are valuable in cases of rheumatism with stiffened joints, but are also employed in various neuralgic conditions, and for some of the manifestations of syphilis.

AZULE SPRINGS,

SANTA CLARA COUNTY.

Location, twelve miles west of San José. Not a resort.

AZULE SPRINGS.

Alkaline-saline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	86.73
Sodium carbonate	52.19
Potassium chloride	10.90
Potassium carbonate	2.85
Magnesium carbonate	78.16
Magnesium chloride	17.42
Calcium carbonate	10.05
Silica	3 20
Organic matter	0.18
Total solids	261.68

Free carbonic acid gas, 153.77 cubic inches.
Temperature, 59.6° F.

The action of the water is antacid, aperient, diuretic, and tonic. The water is used commercially, being shipped in large quantities to all parts of the State. It resembles the water of Nassau Seltzer, in Germany.

BARTLETT SPRINGS,

LAKE COUNTY.

Post-office, Bartlett Springs. Hotel. Access: Since May 1, 1892, the springs are reached by two routes from San Francisco. First, *via* San Francisco and Northern Pacific R. R. Leave San Francisco by the Tiburon Ferry, arriving at Pieta 11.50 A.M. Thence by stage to Lakeport, arriving 4.15 P.M. Thence by fast and well-equipped steamer "City of Lakeport," across Clear Lake, disembarking at Bartlett Station at 5.45 P.M. Thence by a second six-in-hand stage to springs, arriving at 8 P.M.—a beautiful and picturesque route throughout. Second, leave San Francisco *via* Oakland Ferry, 8 A.M., arriving at Colusa Junction at 1.25 P.M. Change to Colusa R. R. A ride of forty-five minutes brings the visitor to Bites at 2.10 P.M. Thence take Miller and Long's stage-coach thirty-five miles to springs, arriving at 9 P.M.

These springs have been known for upward of twenty years, and have gained a wide reputation as a health resort. No more pure and invigorating climate can be found than that of beautiful Lake County, and the Bartlett Springs, being located in a canyon with high mountains on the north and south, are particularly well located to resist sudden changes of temperature. The thermometer shows a mean of 85° F. in the summer, and is never below 20° F. in the winter. The surrounding scenery is grand and inspiring, and once looked upon is not easily forgotten. The elevation above the sea-level is about 2300 feet. On the springs property, consisting of 800 acres, can be found hundreds of mineral springs, no two having exactly the same composition. The following analysis of the principal spring, by Mr. George E. Colby, shows an alkaline-carbonated water of moderate strength and possessing, especially in the sodium, calcium, and magnesium compounds, active remedial agents:

BARTLETT SPRINGS.

Alkaline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.50
Sodium bicarbonate	1.05
Potassium bicarbonate	0.39
Magnesium carbonate	6.62
Calcium carbonate	30.14
Calcium phosphate	0.49
Calcium sulphate	0.63
Iron compounds	Traces.
Silica	3.47
Lithium	Traces.
Barium carbonate	0.05

One U. S. gallon contains :

Solids.	Grains.
Strontium	None.
Boric acid	Traces.
Organic matter	"
Total solids	43.34
Gases.	**Cubic inches.**
Free carbonic acid	24.21
Ammonia	Faint trace.

Temperature of water, 54° F.

An analysis by Dr. Winslow Anderson shows slightly more solids per gallon and a somewhat smaller proportion of carbonic acid. There are said to be slight variations in the constituents of the water, as they are somewhat influenced by the wetness or dryness of the season, etc.

Other well-known springs are the "Soda," "Iron," "Sweet," and "Gas" springs. A feature of great interest in the neighborhood is the gas tunnel, running eighty feet into the mountain side. This tunnel has had for years a steady and large flow of carbonic-acid gas. It rises to a height of about eighteen inches, and is so heavy that it is said to roll down the mountain side in a considerable volume. Birds, rabbits, squirrels, lizards, etc., in trying to cross its path are asphyxiated, and skeletons of some of these victims may be seen for quite a distance from the tunnel's mouth.

The hotel is kept open the year round, but the season proper at Bartlett is from May 1st to November 15th. During this time from 300 to 500 guests are always on the grounds. Beside the hotel there are numerous cottages provided for those preferring housekeeping.

The waters are highly recommended in chronic rheumatism, gout, sciatica, calculous diseases, dyspepsia, chronic alcoholism, etc. They are bottled and have an extensive sale on the Pacific coast.

In the neighborhood of Bartlett Springs are two spring resorts where the waters are used for bathing. They are known respectively as Newman's Soap Springs and the Crabtree Hot Springs. Both are thermal.

BLODGETT'S SPRINGS,

SANTA CLARA COUNTY.

Hotels and cottages. These excellent springs are picturesquely located in the Coast Range of mountains, about eight miles west of Gilroy. They are reached by the Southern Pacific R. R. to Gilroy, and from thence by a daily stage. The surroundings are beautiful. The atmosphere is pure, balmy, and invigorating, and the mineral water and baths are of considerable therapeutic value. One of the principal fountains is the Soda Spring. Anderson's analysis:

BLODGETT'S SPRINGS.

Alkaline-carbonated. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	8.20
Sodium carbonate	9.92
Sodium sulphate	Trace.
Potassium chloride	"
Potassium iodide	"
Potassium carbonate	0.47
Magnesium carbonate	6.65
Magnesium sulphate	1.15
Calcium carbonate	7.31
Calcium sulphate	2.19
Ferrous carbonate	Trace.
Alumina	4.13
Borates	Trace.
Silica	4.11
Organic matter	Trace.
Total solids	44.13
Gases.	**Cubic inches.**
Carbonic acid	9.25
Sulphureted hydrogen	Trace.

The waters are antacid, diuretic, aperient, and tonic, and of value in acid dyspepsia and catarrh of the stomach, constipation, kidney and bladder troubles.

The next spring in importance is the Sulphur Spring. It is very similar in chemical composition to the Soda Spring, but contains a much larger volume of sulphureted hydrogen (7.25 cubic inches per United States gallon). This water is also antacid, laxative, tonic, and diuretic, and is said to be useful in rheumatism and sciatica, chronic arthritis, and skin diseases. Excellent bathing facilities have been constructed.

BONANZA HOT AND COLD SPRINGS,

LAKE COUNTY.

These springs are located two miles from Siegler's, six miles from Glenbrook, and eight miles from Lower Lake. The situation is about 2500 feet above the sea-level, in a sequestered spot on the side of the mountain, among the pines and oaks. There are several pleasant carbonated waters on the place. One of these, the Cold Soda, is a sparkling, antacid water, possessing diuretic and aperient properties. On qualitative analysis the Soda Spring is found to contain sodium carbonate, potassium carbonate, magnesium sulphate, calcium carbonate, silica, and free carbonic acid gas. Another spring close by is found to be sulphureted, and has a temperature of 84.2° F. This spring is used for bathing.

It yields on analysis: sodium sulphate, sodium chloride, magnesium sulphate, calcium carbonate, calcium sulphate, silica, and free sulphureted hydrogen gas. It is beneficial in gouty and strumous joint affections.

BORAX SPRINGS.

There are numerous springs, ponds, and lakes yielding borates in Lake and San Bernardino Counties, as well as in the more southern parts of the State. These are not utilized as health resorts, but yield large amounts of borax. According to the reports of the State Mineralogist, California produced more than $5,000,000 worth of this useful substance during the last twenty years.

BYRON SPRINGS,

CONTRA COSTA COUNTY.

Post-office, Byron Springs. Hotel and cottages. These excellent springs are pleasantly situated near the foot-hills in a spur of the Coast Range of mountains, about sixteen miles southeast of Mount Diablo, and sixty-eight miles northeast of San Francisco. They are reached by the railroad line running from San Francisco to Stockton and Sacramento *via* Martinez. The springs are one and a half miles from Byron Station on this line. They lie in a small valley leading from the San Joaquin plains. The elevation is about 100 feet above tide-water, and the climate is mild and pleasant. An excellent hotel and a number of cottages have been erected for the accommodation of guests. Being only three hours' ride from San Francisco, the place is visited by thousands of people every year, and is constantly increasing in popularity. The springs are upward of fifty in number, and many of them are of great therapeutic value. They range in temperature from 52° to 140° F. Within a few feet of each other one finds a cold carbonated spring and a hot sulphureted spring. The entire basin has the appearance of being an extinct volcanic crater. The cold soda springs probably come largely from the surface-water, while the hot springs undoubtedly have a much deeper origin down in the earth's crust. There are also several inflammable gas wells or springs, from which it is hoped an abundant supply of natural gas for illuminating and heating purposes will be obtained. The gas evidently consists in great part of carbureted hydrogen (CH_4). Of the fifty or more springs only seven or eight are in active use. We present several analyses made by Dr. Winslow Anderson:

THE "LIVER AND KIDNEY" SPRING.

Muriated-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	622.07
Potassium chloride	33.74
Potassium iodide	0.79
Potassium bromide	Trace.
Magnesium chloride	3.92
Magnesium carbonate	15.75
Calcium chloride	85.37
Calcium sulphate	1.12
Calcium carbonate	0.59
Barium carbonate	0.93
Ferrous carbonate	0.72
Ammonium chloride	0.05
Silica	1.00
Organic matter	Trace.
Total solids	769.05

Free carbonic acid gas, 7.82 cubic inches.
Temperature of water, 66° F.

The analysis shows this water to be heavily impregnated with saline ingredients. The water is said to have a special action on the liver and kidneys, which fact gives the spring its name. Before the resort was improved it was the custom of the residents of the surrounding country to come with bottles and barrels and carry the water away for use. It is said to be very useful in dyspepsia, chronic hepatic diseases, obstruction in the gall-ducts, and what is known as "gin livers." Its good effects are extended to intestinal atony or torpidity of the bowels. It is diuretic, and is said to have been successful in a number of cases of albuminuria. Its best effects are observed in alcoholic dyspepsia and in the "rocky" and dilapidated state of the system consequent upon excessive conviviality. It was resorted to in these conditions long before an analysis was made.

THE "WHITE SULPHUR SPRING."

Alkaline-saline-chalybeate. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	12.01
Sodium bicarbonate	12.94
Sodium sulphate	1.34
Potassium chloride	Trace.
Potassium carbonate	2.37
Potassium sulphate	Trace.
Magnesium chloride	"
Magnesium carbonate	2.50
Calcium carbonate	1.13
Calcium sulphate	0.51

One U. S. gallon contains:

Solids.	Grains.
Ferrous carbonate	3.00
Silica	0.26
Organic matter	Trace.
Total solids	36.06
Gases.	**Cubic inches.**
Carbonic acid gas	21.17
Sulphureted hydrogen	5.80

Temperature of water, 76° F.

This will be seen to be a light alkaline sulphur water, with a well-marked quantity of ferruginous salt. Its action is tonic, diuretic, alterative, aperient, and antacid. It is very useful in affections consequent upon the uric-acid diathesis, such as rheumatism, gout, glandular enlargements, and many forms of skin disease.

THE "BLACK SULPHUR SPRING."

Saline-sulphureted. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	395.00
Sodium sulphate	Trace.
Sodium bicarbonate	"
Potassium chloride	35.62
Potassium sulphate	Trace.
Potassium iodide	0.74
Potassium bromide	0.16
Magnesium chloride	1.00
Magnesium carbonate	9.50
Calcium chloride	9.00
Calcium sulphate	3.20
Calcium carbonate	5.95
Ferrous carbonate	0.70
Barium carbonate	Trace.
Ammonium chloride	"
Silica	1.10
Organic matter	Trace.
Total solids	461.97
Gases.	**Cubic inches.**
Carbonic acid	25.60
Sulphureted hydrogen	8.00

Temperature of water, 90.3° F.

This water contains a considerable quantity of the chlorides and carbonates, and is largely diuretic in consequence. It is also heavily charged with carbonic acid gas, and has a fair amount of sulphureted hydrogen gas. It is indicated in catarrhal irritation and inflammation of the genito-urinary tract, and has proved of service in cystitis, Bright's disease, dyspepsia, and constipation. It is largely used for bathing purposes.

Among other valuable springs at Byron are the "Iron" Spring, a well-marked alkaline chalybeate water; the "Hot Salt" Spring, having a temperature of 122.3° F., and much used for bathing; the "Iron Pipe" Spring, and the "Surprise" Spring. This latter spring is one of the most heavily charged saline waters in the world, containing 15,000 grains of common salt to each United States gallon of 231 cubic inches. With other mineral ingredients it is known to possess over 18,000 grains—about 40 ounces, or 33 per cent., of solid constituents to the gallon. The following comparative table of heavy waters shows the Surprise Spring to be one of the most remarkable known:

One U. S. gallon contains:	Grains.
Sea water	2,138.91
Mono Lake (California)	2,915.16
Castalian Mineral Spring (California)	4,422.25
Owens Lake (California)	7,000.60
Syracuse, New York (salt well)	9,221.00
Salt Lake (Utah), about	11,000.00
Dead Sea (Holy Land)	13,488.10
St. Clair Springs (Michigan)	17,704.60
Clark's Red Cross Mineral Springs (Michigan)	17,825.77
Byron Surprise Spring	18,773.73

The water is highly diuretic and laxative when taken internally, and ought to be valuable for bathing purposes. Two large bath-houses have been built at Byron, fitted with sulphurous, steam, vapor, and water baths in tub or plunge, at all temperatures. The moor or mud baths form an important feature of this resort. The hot sulphurous, saline mud has become famous in the treatment of obstinate cases of rheumatism, gout, arthritic joints, scrofula, and skin diseases. The following analysis shows the mineral constituents of this mud:

One U. S. gallon contains: Solids.	Grains.
Sodium chloride	274.93
Sodium sulphate	42.16
Potassium chloride	26.40
Potassium iodide	0.32
Potassium bromide	Trace.
Magnesium chloride	2.06
Magnesium sulphate	19 60
Calcium chloride	7.50
Calcium sulphate	36.05
Calcium carbonate	3.09
Ferrous sulphate	0.76
Ammonium chloride	Trace.
Silica	5.62
Organic matter	7.34
Total solids	425.83
Gases.	Cubic inches.
Free carbonic acid	17.75
Free sulphureted hydrogen	14.50

Temperature of mud, 110° F.

CALIFORNIA SELTZER SPRINGS,

MENDOCINO COUNTY.

These springs are pleasantly located in the Coast Range, twelve miles from Cloverdale. The surroundings are picturesque, and the climate is salubrious. There are comfortable accommodations for visitors.

On analysis the Seltzer Spring was found by Anderson to be composed as follows:

CALIFORNIA SELTZER SPRINGS.

Alkaline-saline-calcic. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	17.15
Sodium bicarbonate	53.00
Sodium carbonate	Trace.
Magnesium carbonate	44.60
Ferrous carbonate	Trace.
Calcium carbonate	72.40
Organic matter	Trace.
Silica	"
Total solids	187.15

Free carbonic acid gas, 18.00 cubic inches.
Temperature of water, 57° F.

The waters are sparkling and quite palatable. They have a diuretic and aperient action, and are beneficial in dyspepsia with acid eructations, constipation, acid states of the urine, cystitis, etc. They belong to the alkaline-carbonated class.

CALISTOGA SPRINGS,

NAPA COUNTY.

These valuable springs are situated nine miles south of Mount St. Helena. There are two sets of springs, one in the City of Calistoga and the other just outside the town. They are very similar in chemical composition. There were at one time an excellent hotel and many fine cottages at the springs, but since the fire in 1868, which destroyed the former and several of the latter, the resort has changed hands many times, and has been allowed to languish somewhat. It is said that the present proprietor contemplates fully restoring the once handsome resort.

The mineral springs number some twenty or more, and range in temperature from 75° to 186° F. They are used for drinking and bathing purposes, and have acquired considerable reputation. The following analysis was made by Dr. Anderson of the waters of one of the springs at Magnolia Hotel:

CALISTOGA SPRINGS.

Saline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	20.76
Sodium carbonate	5.10
Sodium sulphate	1.75
Sodium iodide	0.16
Potassium iodide	Trace.
Magnesium sulphate	2.90
Calcium chloride	5.57
Calcium sulphate	0.63
Alumina	0.47
Silica	4.55
Organic matter	Trace.
Total solids	41.89

Free sulphureted hydrogen gas, 4.75 cubic inches.
Temperature of water, 95° F.

The following analysis shows the mineral ingredients of the Hot Swimming Pool on Senator Stanford's grounds:

SWIMMING POOL (CALISTOGA SPRINGS.)

Saline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	23.07
Sodium carbonate	2,19
Sodium sulphate	6.92
Sodium iodide	0.73
Potassium iodide	0.21
Potassium carbonate	0.76
Magnesium sulphate	1.16
Magnesium chloride	0.40
Calcium chloride	0.96
Calcium sulphate	1.25
Ferrous protoxide	0.45
Manganese	Trace.
Alumina	0.27
Silica	3.61
Organic matter	Traces.
Total solids	41.98

Sulphureted hydrogen gas, 6.30 cubic inches.
Temperature of water, 121.6° F.

The springs have gained considerable celebrity in obstinate cases of syphilitic contamination, rheumatism, etc.

CASTALIAN MINERAL SPRINGS.

Inyo County.

These springs are found near Owens Lake, and are thirteen in number, most of them being cold. One or two are sulphurous, and the others are alkaline and carbonated. The place is being developed as a resort. Some of the waters are also used commercially, and are recommended in cutaneous diseases. The following analysis of one of the springs was made by Prof. Thomas Price in 1880:

CASTALIAN MINERAL SPRINGS.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	1724.11
Sodium sulphate	651.02
Sodium sulphate (?)	46.34
Sodium chloride	1840.72
Potassium chloride	132.30
Lime	Trace.
Magnesia	"
Silica	14.28
Boric acid	Trace.
Phosphoric acid	"
Iodine	"
Bromine	"
Iron	"
Organic matter	13.48
Total solids	4422.25

Gases not determined.

This is an exceedingly dense alkaline-saline water and cannot be used medicinally without dilution. There are other springs close by not so heavily impregnated.

COAL VALLEY BOILING SPRINGS,

MODOC COUNTY.

These springs lie eight miles west of Modoc. They are not improved, and are mentioned here on account of their high temperature—212° F., that of boiling-water. An egg boils in the water in a few minutes. White incrustations of soda salts form about the margins of the springs.

CORONADO SPRINGS,

SAN DIEGO COUNTY.

Hotel. These springs are located on and in the vicinity of Coronado Beach. They have an elevation of 30 feet above the ocean tide, and flow 50,000 gallons per hour. The water is clear and sparkling, and pleasant to the taste, being soft, pure, and wholesome. On analysis it was found by Mr. C. Gilbert Wheeler, analyst, to contain the following mineral ingredients:

CORONADO SPRINGS.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	10.17
Potassium chloride	0.91
Potassium sulphate	0.55
Magnesium	4.73
Calcium carbonate	6.49
Calcium sulphate	1.33
Ferrous sesquioxide	0.04
Silica	1.08
Organic matter	0.99
Total solids	26.29

Gases not determined.

This water is found to compare favorably with that of the Bethesda Spring at Waukesha, Wis. That well-known water contains slightly more than 25 grains of solid matter to the United States gallon, many of the constituents being the same as those of the Coronado waters. These waters are gently aperient, diuretic, and tonic, and useful in dyspepsia, anæmia, renal and cystic disorders.

The accommodations at the Coronado Hotel are among the finest in the world. The building is a magnificent structure, and the scenery on the beach, on the shore of the Pacific Ocean, is never to be forgotten by one fortunate enough to have beheld it.

DUNCAN SPRINGS.

MENDOCINO COUNTY.

Post-office, Hopland. Hotel and cottages. Access *via* San Francisco and Northern Pacific R. R. to Hopland Station. The new hotel is located on a picturesque knoll, half a mile from the station. The springs are found on a hill 250 feet above the valley and 1000 feet above the sea level. The surrounding country is of a rough, broken character, and the climate salubrious. The flow of water from the principal spring, the Duncan, is 1½ gallons per minute. There are several other springs, known as the "Seltzer," the "Iron," the "Borax," and the "Sulphur" Springs, their names indicating in a general way their character. The following analysis by A. W. Thatcher shows the mineral ingredients of the principal spring:

DUNCAN SPRINGS.

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Magnesium bicarbonate	90.11
Magnesium chloride	1.41
Magnesium sulphate	1.64
Calcium bicarbonate	15.64

One U. S. gallon contains:

Solids.	Grains.
Silica	6.94
Potassium bicarbonate Sodium bicarbonate	2.37
Total solids	118.11

Free carbonic acid gas, 36.57 cubic inches.

The waters are said to be much sought after in the treatment of rheumatism, dyspepsia, and constipation.

EL PASO DE ROBLES HOT AND COLD SULPHUR SPRINGS,

San Luis Obispo County.

Hotel and cottages. These springs lie in the beautiful valley of the Salinas River, about sixteen miles from the shores of the Pacific Ocean, and 216 miles from San Francisco. They are reached by the Southern Pacific R.R. *via* Soledad. Access may also be had from San Luis Obispo by stage. The name of El Paso de Robles is derived from the Spanish, meaning "the pass of the oaks," from the fact that the main highway ran through this valley. For many miles this picturesque valley is covered with gigantic white oaks, live oaks, and huge cottonwoods, and nestled in one of these cosey groves is Paso Robles Retreat. The once wild "pass in the oaks" is now transformed into a blooming resort, with cultivated grounds, and Paso Robles is a delightful little town of about 1000 inhabitants. When the Southern Pacific Railroad is completed the place will become of considerable commercial importance. Near the springs and overlooking the prosperous little town a commodious and elegant hotel is under construction. The building will be of solid brick throughout. Some eighteen or twenty cosey cottages are also found under the umbrageous oaks in different parts of the extensive grounds. On each side of the resort and valley the evergreen hills, covered with forests of pine, oaks, manzanita groves, and sweet-scented shrubbery, form a pleasant contrast to Paso Robles proper.

The climate is remarkably mild and luxurious all the year round, and the atmosphere is pure, balmy, and invigorating.

The waters at Paso Robles are sulphurous and alkaline, and range in temperature from 59° to 122° F. They comprise the "Main Hot Sulphur" Spring, the "Mud or Moor" Spring, the "Soda," "Sand," "Cold," "White Sulphur," "Iron," and "Garden" Springs. The great hot sulphureted spring is located about 300 yards from the hotel in a southeasterly direction. Over it has been constructed one of the finest bathing establishments on the coast, consisting of sixty individual bath-tubs, and a large vat, 15x30 feet, for a swimming or plunge bath. The flow of this spring is about 5000 gallons per hour, and it has a temperature ranging from 105° to 110° F. The following analysis was made by Dr. Winslow Anderson in 1889:

EL PASO DE ROBLES (MAIN SULPHUR SPRINGS).

Alkaline-saline. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	25.73
Sodium bicarbonate	41.19
Sodium carbonate	7.62
Sodium sulphate	7.25
Sodium iodide	Trace.
Sodium bromide	"
Potassium chloride	1.57
Potassium carbonate	2.05
Potassium iodide	Trace.
Potassium sulphate	"
Magnesium carbonate	2.15
Magnesium sulphate	5.11
Calcium carbonate	1.23
Calcium sulphate	2.94
Ferrum peroxide	0 73
Borates	Trace.
Lithates	"
Alumina	0.25
Silica	1.75
Iodides and bromides	Trace
Organic matter	1.90
Total solids	101.47

Gases.	Cubic inches.
Free sulphureted hydrogen	3.75
Free carbonic acid gas	8.90

These waters are found to be especially serviceable in subacute and chronic rheumatism and articular affections, scrofula, blood, glandular, and cutaneous affections. In catarrh of the nasopharynx the water, used as a hot douche, has proved highly beneficial. It is also useful in this manner in leucorrhœal discharges and in engorgement of the female pelvic organs.

The Mud Springs, about a mile and a half north of the hotel, are also exceedingly beneficial in rheumatism, arthritis, stiff joints, sprains, synovitis, glandular enlargements, chronic cutaneous diseases, etc. They vary in temperature from 104° to 122° F., and have been found to be highly charged with mineral and gaseous ingredients. The mud springs cover a space of about twenty-five feet square, over which suitable bathing conveniences have been established. These consist of dressing-rooms, hot sulphurous water, plunges, and the mud plunge; this latter is a compartment or vat 4x8 feet and nearly filled with prepared moor or mud, and so arranged that the hot sulphurous water and gases rise directly into it from the ground beneath. The mud springs flow collectively about 6000 gallons per hour. About 200 yards north of the Mud Baths is the Soda Spring. Its temperature is 77° F., and its flow is limited. The water is much used for drinking purposes. By allowing the small amount of sulphureted hydrogen to escape the water becomes very palatable. According to Anderson's analysis—

One U. S. gallon contains: Solids.	Grains.
Sodium chloride	25.10
Sodium carbonate	7.25
Sodium bicarbonate	19 70
Sodium sulphate	5.05
Potassium carbonate	1.16
Potassium sulphate	0.83
Magnesium carbonate	3.17
Magnesium sulphate	7.80
Calcium carbonate	5.32
Calcium sulphate	6 47
Iron peroxide	Trace.
Silica	0 92
Alumina	0.85
Organic matter	Trace.
Total solids	83.82
Free gases.	Cubic inches.
Carbonic acid gas	9.20
Sulphureted hydrogen	1.60

The water has valuable antacid and aperient properties. It belongs to the alkaline-carbonated class. The other springs at Paso Robles are not extensively used as yet, although some of them will, no doubt, be found very valuable.

EUREKA SPRINGS,

HUMBOLDT COUNTY.

Post-office, Eureka. These springs are located near the town of Eureka. The waters belong to the muriated-sulphureted class, and were analyzed by Prof. W. D. Johnson in 1885, with the following results:

EUREKA SPRINGS.

Muriated-saline. Sulphureted.

One U. S. gallon contains: Solids.	Grains.
Sodium chloride	1403.00
Sodium carbonate	10.10
Sodium bromide	14.00
Potassium sulphate	12 20
Magnesium chloride	101.00
Magnesium sulphate	211.30
Calcium carbonate	3 80
Calcium sulphate	42.50
Alumina	1.30
Silica	0.95
Ferrous carbonate	0.12

One U. S. gallon contains:

Solids.	Grains.
Manganese	Trace.
Boric acid	"
Iodine	"
Lithium	"
Total solids	1800.27
Gases.	
Carbonic acid gas	Small amount.
Sulphureted hydrogen	Saturated.

This water is now used extensively by the residents of the neighboring districts. It is also shipped to San Francisco. The action of the water is laxative and diuretic.

FELT'S MINERAL SPRINGS,

HUMBOLDT COUNTY.

Hotel. These springs lie about twenty-five miles from Eureka, near the head of Strong's Valley. There are numerous springs on the place, the most important yielding on analysis:

Sodium chloride.
Sodium carbonate.
Potassium chloride.
Potassium carbonate.
Potasssium sulphate.
Silica.
Magnesium chloride.
Magnesium carbonate.
Calcium carbonate.
Manganese.
Traces of iron.
Alumina.

The grounds are elegantly laid out, and commodious quarters have been erected for the accommodation of guests. The resort is illuminated by natural gas from the premises.

The waters are especially recommended in dropsical tendencies depending on the liver and kidneys.

FULTON WELLS,

LOS ANGELES COUNTY.

Hotel and cottages. This resort is located about three miles north of Norwalk Station on the Los Angeles R. R., and thirteen miles from Los Angeles City.

The wells were bored by Dr. Fulton, and the resort is conducted by that gentleman. The two principal wells are 350 feet deep and flow copiously. Anderson's analysis shows the following results:

FULTON WELLS.

Alkaline-saline-chalybeate. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	9.60
Sodium bicarbonate	2.90
Sodium sulphate	0.95

One U. S. gallon contains:

Solids.	Grains.
Magnesium bicarbonate	17.46
Ferrous carbonate	11.75
Calcium carbonate	12.62
Calcium sulphate	23.41
Silica	2.45
Organic matter	Trace.
Total solids	81.13
Gases.	
Free carbonic acid gas	Excess.
Free sulphureted hydrogen	"

Temperature of water, 64° F.

This water may be described as a heavy alkaline-chalybeate. It enjoys considerable reputation in the treatment of anæmia, malarial troubles, atonic dyspepsia, congestion of the liver, etc.

A large hotel, comfortable cottages, and excellent bathing facilities have been provided for guests.

THE CALIFORNIA GEYSERS,

SONOMA COUNTY.

Hotel and cottages. This marvellous region is located in the northeastern part of Sonoma County, about one hundred miles north of San Francisco, sixteen miles from Cloverdale, and twenty-six miles from Calistoga. Formerly tourists rode on horseback for many miles to visit this realm of fumaroles and solfataras, which is situated about 1700 feet above the sea-level; but, thanks to the push and enterprise of our Western civilization, it may now be reached in a comfortable six-horse stage from the termini of the Cloverdale and Calistoga railroads over excellent mountain roads. It is a good plan to go by the way of Cloverdale and come back by way of Calistoga, as all the grandeur and beauty of the surrounding country may thus be seen. The following entertaining account of a visit to the Geysers is taken from Dr. Anderson's work:[1]

"Leaving Cloverdale after luncheon, comfortably seated in our stage, with an experienced and accommodatingly communicative driver, who takes pleasure in pointing out the many objects of interest, we soon cross the Russian River and commence the ascent. The hills and mountains are robed in evergreen verdure of indigenous flora, gigantic oaks, and towering pines. Here and there the huge bowlders and rocky cliffs stand out in bold relief, and as we wind up and around the mountain sides with the Pluton River many hundred feet below, basking and smiling in the afternoon sun, and rippling along its moss-covered banks and bright-pebbled bottom, with here and there a miniature cascade and waterfall, we feel that words cannot describe the grandeur of the scenery. . . .

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[1] Op. cit.

"As we gain in altitude the view becomes more and more extended, until our eyes leap with vivid interest from peak to peak and valley to valley for miles around, feasting upon the beauties of nature. Some two or three miles down the canyon before we reach the geysers our attention is called to the large white or yellowish-white banks across the canyon. They are known as sulphur banks, and consist of deposits of sulphur and cinnabar, with incrustations of salts of sodium, potassium, magnesium, sulphur, etc. They are extinct craters, or the deposits of geysers and fumaroles which have died out, leaving evidences of volcanic action behind. Near these sulphur banks are found the famous Indian Springs, at which Edwin Forrest camped for one season and was completely restored to health."

The waters are diuretic, laxative, and antacid, and are valuable in dyspepsia, torpidity of the liver and bowels, and in renal and cystic diseases. (See table for analysis.)

Near by are the real "Indian Mud Springs," which are highly extolled in the treatment of chronic rheumatism, gout, arthritis, and synovitis, and scrofulous and cutaneous contaminations. (See table.)

"As we draw nearer and nearer the sylvan resort our ears are greeted with sounds like those of a steamboat or locomotive—puff, puff—at regular intervals. These we are told, and as we ascertained afterward, come from the 'Steamboat Springs.' After a few more horseshoe curves have been passed and several more of those magnificent landscapes have been mentally photographed on the brain, we reach the geyser resort. The many cosey cottages, the hotel and grounds, are situated in a leafy dell on the side of the mountain opposite the Geyser Canyon. The huge oaks and pines afford pleasant shade to the commodious verandas as we sit and enjoy the pure, dry, invigorating and exhilarating mountain air and picturesque scenery which surrounds us on every side."

A Trip Through the Geyser Canyon.

"Bright and early next morning we set out for our trip 'over the river' to his Majesty's Plutonian shores. In the summer the best time out is from 4.30 to 5 A.M., in order that the full volume of the steam and sulphurous vapors may be perceived as they rise several hundred feet in the air. Later in the morning the sun's rays condense the vapors so that they are not visible so far above the ground. We are armed with a long staff, like the pilgrims of old, and with our guide we set out to cross the Pluton River—this time on a bridge. Before doing so, however, our attention is called to a clear, cool spring known as the 'Iron' Spring. It is located near the edge of the Pluton River on the same side as the hotel."

The water of this spring belongs to the light chalybeate class (see table); its action is tonic, aperient, and detergent.

"Immediately after crossing the Pluton River a change in the atmosphere becomes noticeable. On the side where the hotel is built the air is pure, dry, and invigorating; on the side where the Geyser Canyon is located the atmosphere is mixed with the perfumes from the interior realm. Near the path on the bank of the river as we proceed up the canyon is situated quite a remarkable spring, containing large quantities of aluminum, sulphate of magnesia, and silicic acid. It is known as the 'Alum Spring' (see table).

" Following our guide, we soon realize that we are nearing the brink of eternity. We cross the Devil's or Geyser Canyon and come to the alum and sulphur spring, having a temperature of 160° F. Proceeding further on we next come to the 'Black Sulphur Springs,' in which we find sulphide of iron. The ground is now getting warm under our feet, and the fumes from the 'lower regions' make us think of the hereafter, and as we push on a deep and steep ravine is entered, from which boiling hot steam and gases escape in every direction until we feel awe-struck in this strange place. Passing along through the ravine with the boiling water running at our feet we enter Proserpine's Grotto, in which is placed the 'Devil's Armchair.' This latter is hollowed out in the shape and form of a large parlor chair. In this we sit with great solemnity, to make sure of the benevolent friendship of his Satanic Majesty. The next point of interest in this Dante-like pilgrimage is the 'Devil's Kitchen,' with warning signs of danger stuck up on every hand. The country rock is serpentine sandstone and limestone, with igneous deposits and incrustations of sulphur, soda, cinnabar, etc., and as the fumaroles, cracks, and fissures emit their boiling waters and vapors saturated with free sulphuric, sulphurous, and hydrochloric acids and carbonic anhydride, all having a strong disintegrating action on the formation, everything is in consequence soft and yielding. The banks and rocks are like clay and sand, easily dislodged upon the slighest touch, hence the signs of danger. We are now fairly in the mouth of a boiling, seething, trembling, and smoking Plutonian realm. The ground under our feet is becoming hotter and hotter, and the sulphurous fumes and vapors are nearly suffocating. . . . ." In this olla podrida of Hadean liquids are a number of interesting points, including several springs, to be observed. Near at hand is a hot "Epsom Salt" spring, having a temperature of 150° F. and containing over 140 grains of magnesium sulphate to the gallon of water. Another boiling spring of iron and sulphur has a temperature of 208° F. On the right side of the path is a large, black, sulphurous spring continually boiling and rumbling as the black, inky fluid reaches the dawn of day at a temperature of 162° F. It is the "Devil's Inkstand"—a hot, sulphurous, iron and alum sulphide and sulphate water, which makes very fair writing fluid. For this purpose it is used at the Geyser Hotel, where the visitor inscribes his name on the register with his Majesty's ink.

You next come to the "Hot Alum Spring," containing over sixty grains of aluminium sulphate to the gallon (see table). This spring water is an excellent hæmostatic in hemorrhages from the lungs, etc. Its action is at once tonic, laxative, and astringent.

"As we proceed along the not over 'straight and narrow path' it is literally and practically important that we follow our guide and the 'narrow path' here, lest one misstep hurl us into that 'undiscovered country from whose bourne no traveller returns.' Innumerable springs and vents and subterranean outlets spurt and spout in every direction. 'Pluto's Punch-bowl' is a large spring of hot lemonade, containing sulphuric acid and sulphates. The 'Geyser Smokestack' is a large opening from which issue volumes of sulphur-laden fumes, which rise into the air for several hundred feet, where they condense and deposit again on the ground as water and sulphur, etc. One of the most interesting springs in the Geyser Canyon is the 'Witches' Caldron,' a large, boiling circular spring over seven feet in diameter and of unfathomable depth. The water has a temperature of 212° F., and is unceasingly boiling and bubbling. . . ."

On analysis this remarkable fumarole, having its source probably hundreds of feet below the surface, yields water rich in sodium, calcium, and magnesium sulphates. (See table.)

"Next comes the 'Devil's Canopy' and the 'Geyser Safety-valve,' an intermittent, scalding spring, which ejects streams of boiling water to the height of fifteen feet; then the 'Devil's Pulpit,' a little elevation where his Satanic Majesty (presumably) goes to direct the workings of his laboratory. A little farther up and to the left are the wonderful 'Steamboat Geysers,' which can be heard a mile or more away, blowing and snorting intermittently at high pressure. This is seemingly a true geyser. The steam is so hot that it does not begin to condense until it is ten or fifteen feet from the surface. Tourists are apt to burn their fingers trying to find out what makes the noise, as the steam is not visible. The temperature here is 214° F. . . ."

We then pass on to the "Devil's Grist-mill," where a large column of steam escapes from a hole in the rock with so much force that sticks and stones placed at the orifice are blown away like bits of paper. Loud subterranean noises are heard within, resembling those of a grist-mill, hence its name. Going still farther up the ravine is found to bifurcate. The left fork is still active, having dozens of springs, with temperatures ranging from 100° F. to 210° F. The right fork is cool and pleasant, with several pure water springs.

"Ascending at the bifurcation some 160 feet we come to an elevation—a plateau of smooth, plastic clay, stained with iron and sulphur. This clay has a temperature of 170° F. A long pole is introduced into the yielding formation, and forthwith issue hot, smoking vapors. The edge of this plateau is called 'Lover's Leap.' Here the view of the boiling, seething, roaring, steaming, groaning, and bubbling springs below is one of unrivalled grandeur. One hundred and sixty feet below you and all along the Devil's Canyon is one mass of smoking fury, shrill whistles, regularly intermittent puffs, and groans issuing from the interior of the earth. . . ."

To the eastward is "Lover's Retreat," a pleasant oasis in this wilderness of sulphurous clouds. Here, also, is the "Temperance Spring" of clear, cold water. Near it is a large, fallen oak which serves at once for a seat, and a knot-hole in one of the huge branches is known as the "Post-office." Here we leave our cards, in case civilization is never reached again. "Going along the usual route we pass over the 'Fire Mountain,' with its hundreds of small orifices through which miniature geysers issue. The temperature of this ochreous clay is 175° F. A little east of this are located 'Alkali Lake' and the 'Lava Beds.' Here the crust is so thin that stamping on it causes a hollow sound. This is evidently an extinct volcanic crater on a small scale.

"We now pass the 'Indian Sweat Bath' and come to another remarkable spring known as the 'Devil's Teakettle.' This is one of the strongest vapor springs on the coast. The orifice is three feet in diameter, and opens out of the side of the mountain, with a huge bowlder overhanging it. 'Teakettle Spring' is about half a mile from the active springs in Geyser Canyon. The vapor is emitted with such force that a large bunch of brush placed in front of it is instantly swept away for many feet. This steam is above the boiling point, and is sulphurous in character, and contains a large quantity of free sulphuric acid. Formerly, a huge cone with a steam whistle attached to it was constructed over the orifice, but it made such a noise as to keep the guests awake at nights, and was therefore taken down. (See table for analysis.)

"The route now lies along the side of the mountain, where a narrow path has been cut out of solid igneous rock. Below is the Pluton River, and above the snorting geysers. Issuing from the side of the solid glass mountain are the remarkable springs, the 'Hot Acid' and the 'Lemonade,' whose waters are rich in potassium salts, so valuable in many conditions and diseases. The acid spring is remarkable from the fact that it contains 154 grains of free sulphuric acid to the gallon, and the lemonade spring from the fact that it is one of the few springs in California which has free muriatic acid (see table). These waters are among the finest in the State for dyspepsia, torpidity of the liver and bowels, malaria, anæmia, and many blood, glandular, and cutaneous affections. . . . ."

The next place of interest is the "Devil's Oven," a large excavation in this silicon oxide mountain, where in years gone by the igneous rock was at a white heat. All over this realm of subterranean outlets the crust of the earth is covered with the products of the Plutonian shores—sulphur, iron, magnesia, nitre, alum, etc.

On again reaching Pluton River several more cold and hot springs are seen. Some are sulphureted and others are ferruginous, magnesic, and aluminic. Several hundred feet up the Pluton River has been constructed a large and commodious bathing establishment, which spans the river. Every facility for bathing has been arranged. The hot sulphurous vapor issues directly through the side of the mountain and gains admission into suitable apartments where the bather can enjoy the medicinal effects of the sulphurous fumes and steam vapors at any desired temperature. This bathing fluid is remarkable on account of the large amount of borates it holds in solution (see table for analysis). This is one of the best bathing waters on the coast. The borates and sulphates render the skin soft, white, and pliable; it has proved highly beneficial in the treatment of many cutaneous, syphilitic, and strumous contaminations, rheumatism, and chronic joint troubles, white swellings, gout, and other articular diseases. Internally the action of the water is laxative, diuretic, and diaphoretic. A large swimming pond has been constructed by damming the Pluton River. The water has a temperature of 75° F., and is a combination of all the mineral spring waters.

ANALYSIS OF WATERS FROM SEVERAL SPRINGS AT THE CALIFORNIA GEYSERS.

Contents per U. S. gallon expressed in grains.	Lemonade Spring, temp. 103° F.	Witches' Caldron, temp. 212° F.	Acid Spring, temp. 140° F.	Alum Spring, temp. 130° F.	Iron Geyser Creek below Alum Sprgs. temp. 96° F.	Spring on side of hill near river, temp. 138° F.	Iron Spring, north of hotel, temp. 70° F.	Indian Spring (second), temp. 101° F.	Mud Indian Spring, temp. 100° F.	Spring, little above Ind. Spring, temp. 105° F.	Hot Sulph. Water, above bath-house, temp. 140° F.	Devil's Teakettle, temp. 212° F.
Potassium bisulphate .	7.53	0.42	1.14									
Potassium sulphate . .	......	......	......	......	......	......	......	0.21				
Sodium bisulphate . .	53.91	39.82	9.62	5.14	......	......	......	......	17.12	......	......	98.16
Sodium sulphate . . .	......	......	......	......	3.15	3.23	......	3.29	......	......	2.36	
Sodium carbonate . . .	......	......	......	......	......	......	......	1.40				
Calcium sulphate . . .	......	6.98	4.44	3.81	5.34	1.10	3.32	......	6.42	8.72	0.65	4.36
Calcium carbonate . . .	......	......	......	......	......	......	......	7.35				
Calcium silicate	......	......	......	......	......	10.18						
Calcium borate	......	......	......	......	......	......	......	......	......	......	6.62	
Magnesium sulphate . .	40.73	9.62	91.29	34.49	16.66	......	2.52	......	59.33	41.12	......	39.09
Magnesium carbonate .	......	......	......	......	......	......	......	15.47				
Magnesium silicate . .	......	......	......	......	......	15.46						
Magnesium borate . . .	......	......	......	......	......	......	......	......	......	......	17.31	
Iron sulphate	12.25	......	16.63	7.34	0.08	0.11	......	......	......	28.81	0.16	
Iron carbonate	......	......	......	......	......	......	0.12	0.07				
Aluminum sulphate . .	32.02	2.04	20.62	63.82	......	0.20	......	......	22.78	118.78	2.39	31.16
Alumina	......	0.27	......	......	0.89	......	0.17	0.18				
Free sulphuric acid . .	31.82	......	154.37	6.45	......	......	......	......	32.30	5.75	......	110.64
Hydrochloric acid . . .	1.19											
Silicic acid	16.50	4.37	21.11	17.26	3.50	17.25	0.99	5.42	12.25	18.08	8.63	12.83
Sulphureted hydrogen .	Sat.	Sat.	Sat.	Sat.	Sat.	......	......	Sat.	Sat.	Sat.	Sat.	Sat.
Boracic acid	......	......	Str. traces		......	......	......	......	......	......	Str. traces	
Total . . .	195.95	63.53	319.22	138.11	29.62	47.53	7.12	33.39	150.20	221.26	38.12	296.24

The geysers are wonderful and picturesque exhibitions of the nearly extinct volcanic forces slumbering beneath the romantic "Devil's Canyon." The region covers an area of about 400 acres, most of the activity, however, being confined to the "Devil's" or "Geyser" canyon, comprising about sixty acres. Collectively, the springs, hot and cold, flow about 100,000 gallons daily. The owners of these valuable springs contemplate making extensive improvements in the near future. New hotels and cottages will be erected, new and complete bathing establishments constructed, and the great natural advantages of the place so improved as to make the "Geysers" one of the world's greatest sanitariums.

From the foregoing analyses made by Professor Thomas Price, it will be observed that at the Geysers can be found probably as great a variety of mineral waters as at any other place on the continent, or perhaps in the world. (See opposite page.)

There are other geysers in various parts of California, but they have not so far reached any great importance as health resorts. Near Litton's Station, in Sonoma County, some few miles from Geyserville, is a pleasant resort known as the "Geyser Spa" or "Soda Springs." The surrounding country is picturesque, and the climate mild and salubrious. A large number of people go to Geyser Spa every year. The waters are highly esteemed for their antacid, diuretic, and aperient properties. The following analysis was made by Dr. Winslow Anderson in 1888:

GEYSER SPA.

Alkaline-chalybeate. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	8.93
Sodium carbonate	4.97
Sodium bicarbonate	21.16
Sodium sulphate	2.60
Potassium carbonate	Trace.
Magnesium bicarbonate	9.03
Magnesium sulphate	1.14
Calcium carbonate	4.90
Ferrous carbonate	2.09
Silica	3.75
Organic matter	Trace.
Total solids	58.57

Carbonic acid gas, saturated.

A previous analysis made by Bauer and Price yielded results almost identical with Anderson's.

GILROY HOT SPRINGS,

SANTA CLARA COUNTY.

Post-office, Gilroy Springs. Hotel. These springs are located on the Coyote River nine miles northeast of the town of Gilroy, in the Santa Clara Mountains. They are reached by the Southern Pacific R. R. to Gilroy, and from thence by stage over a picturesque mountain road. The springs lie nestled in among the mountains, surrounded by fragrant forests of spruce and pine. The atmosphere is rich in ozone, and the climate very genial. There is one main spring, which flows in great abundance. The temperature of the water varies from 108° F. to 115° F. Anderson's analysis :

GILROY HOT SPRINGS.

Alkaline-saline. Sulpho-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	31.75
Sodium carbonate	1.42
Sodium sulphate	0.75
Potassium iodide	Trace.
Potassium sulphate	2,16
Magnesium carbonate	2.45
Magnesium sulphate	9 04
Calcium chloride	8.50
Calcium sulphate	2.70
Ferrous carbonate	0.26
Ferrous oxide	Trace.
Arsenic	"
Silica	3.31
Organic matter	0.52
Total solids	62 86

Gases.	Cubic inches.
Free carbonic acid gas	12.17
Free sulphureted hydrogen	9.25

The analysis shows a light alkaline-sulphureted water. It is used with considerable benefit in syphilis, rheumatism, scrofula, and glandular swellings, chronic skin eruptions, etc. The water is also used for bathing, for which excellent facilities have been constructed.

GLEN ALPINE MINERAL SPRINGS,

EL DORADO COUNTY.

Back in the mountain fastnesses at a distance of seven miles from Lake Tahoe, and at an elevation of 6700 feet above the sea-level, are Gilmore's Glen Alpine Mineral Springs and Health Resort.

The wild, rugged gorge in which they are situated runs back from Tahoe a distance of some ten miles. It is diversified throughout its length with varied scenes of beauty and grandeur, and terminates abruptly in a glacial amphitheatre. The mighty formation which originated here went grinding, crushing, and cutting its way down, forming the beds in which now lie the beautiful lakes, in a chain of which Tahoe is the last link. The old glacier has written its record deep in the granite faces of the majestic mountains, which look down in silence on the results of those terrific convulsions of nature which are still shown in the masses of giant bowlders piled upon their sites, and in the scratched or polished surface of stone in the bed of the canyon below. But there is no suggestion of the chaos and desolation of those days of their birth revealed in the tranquil bosoms of the lakes, which now lie slumbering, or awake and sparkling in the depths of the canyon, where thick groves of pine, tamarack, spruce, and silver fir cast deep, cool shadows. The region is rich in exquisite flowers and ferns. "Those dimpling lakes, with the wild beauty of their surroundings, are sufficient to enthrall the heart of him who visits them; but if he be devoted to the rod and reel he will find an additional charm in the swarms of speckled beauties which sport in the clear depths and rise to the glancing fly."

First in the chain of lakes is the "Half Moon," which lies with Lake "Alta Morris" in the amphitheatre at the head of the canyon. The outlet tumbles down its rocky bed into "Lake Susie," a mile below—a picturesque romantic spot. Nearby is "Heather Lake," which needs a Scott to sing its beauties. The stream continues from Lake Susie, making an abrupt leap at first, which forms the beautiful Glen Alpine Falls; then bubbling on to find "Lake '84," less than a mile below. Leaving that lake the bright stream dashes on, passing the Glen Alpine Springs. There it "glides under lily pods" into a lake named "Lily" from the abundance of its water-lilies. "Fallen Leaf Lake," the gem of the Sierras, is just a mile below "Lily" and separated from Tahoe by a level strip one mile in width. The drive from Tahoe to the head of Fallen Leaf, winding around its shores, is very beautiful. This region has been opened to the public with great labor and expense by the construction of a wagon road as far as Glen Alpine Springs, and mountain trails to all the lakes, including a path for the ascent of Mt. Tallac, which rears its head 10,000 feet above the level of the sea, and commands a wide and magnificent view of the distant peaks and numerous lakes. Good accommodations for guests will now be found at Glen Alpine Springs. Analysis by Dr. Anderson :

GLEN ALPINE SPRINGS.

Alkaline-saline-chalybeate. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	21.17
Sodium carbonate	32.75
Potassium carbonate	Trace.
Magnesium carbonate	9.96
Calcium carbonate	45.09
Calcium sulphate	4.10
Ferrous carbonate	1.80
Alumina	1.43
Boratis	Trace.
Silica	2.50
Organic matter	Trace.
Total solids	118.80

Free carbonic acid gas, 138.36 cubic inches.
Temperature of water, 39.6° F.

The water is very palatable and sparkling. Its action is gently aperient and diuretic, and the water is useful in dyspepsia and torpidity of the bowels as well as in renal and cystic disorders. It contains sufficient iron to give it important properties as a ferruginous tonic.

GORDON SPRINGS,

LAKE COUNTY.

These springs lie in Cobb's Valley, about half-way between Calistoga and Lakeport. They are romantically situated in the heart of a mountain and forest region. The climate is very fine. The location is about 3000 feet above the sea-level. The principal spring flows about 300 gallons of water hourly, having a temperature of 100° F. The waters are sparkling, alkaline, and have antacid and aperient properties. Following is Winslow Anderson's analysis:

GORDON SPRINGS.

Sulphated-saline. Alkaline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	20.75
Sodium carbonate	3.19
Sodium sulphate	8.62
Potassium carbonate	0.73
Magnesium carbonate	6.14
Magnesium sulphate	10.93
Calcium carbonate	11.16
Calcium sulphate	23.46
Alumina	3.55

One U. S. gallon contains:

Solids.	Grains.
Silica	2,27
Organic matter	Trace.
Total solids	90.80

Carbonic acid gas, large excess.

The waters have considerable reputation in chronic albuminuria and in cystitis; they are also valuable in acid dyspepsia. A pleasant resort has been established, and it is worthy of remark that persons suffering from chronic bronchitis, catarrh, asthma, and the early stages of consumption do well at this eyrie among the pines.

HARBIN HOT SULPHUR SPRINGS,

Lake County.

Post-office, Harbin Springs. Hotel. Access: Take boat at Oakland Ferry from San Francisco. At Vallejo change for Napa Valley branch to Calistoga; thence a twenty mile stage ride brings one to the springs. Time from San Francisco, seven and one-half hours. The location is at the base of a spur of the Coast Range of Mountains, 2000 feet above tide-water. Lake County has been justly named the Switzerland of America, and it would be difficult to find a more delightful and picturesque location than that of the Harbin Springs.

"With mountains perpetually clad in garments of evergreen and hills with verdure bright forming the background of the landscape, with brooks and rills now smoothly gliding by moss-covered banks and anon by silvery paths, over shining pebbles, with here and there a miniature cascade, in their ever restless journey to the broad Pacific."

The mountain air is very invigorating and not subject to extremes of heat or cold, the mean temperature being 70° F. The waters are sulphurous and saline, the principal spring flowing 1500 gallons per hour. There is also a small chalybeate fount yielding only sixty gallons per hour. The sulphur spring has a temperature of 122° F., and is used for bathing, for which excellent facilities have been provided. Following is an analysis of this water:

HARBIN HOT SULPHUR SPRINGS.

Saline-chalybeate. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	23.05
Sodium carbonate	5.42
Sodium sulphate	10.19
Potassium carbonate	1.74
Magnesium carbonate	6.18
Magnesium sulphate	11.94
Calcium carbonate	9.10

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	14.63
Ferrous sulphate	1.75
Arsenious salts	0.07
Alumina	1.60
Silica	2.76
Organic matter	Trace.
Total solids	87.43

Gases.	Cubic inches.
Carbonic acid gas	4.26
Free sulphureted hydrogen	11.74

It is said that much benefit accrues from the use of this water in chronic rheumatism and gout and other articular affections as well as in certain varieties of skin diseases.

The chalybeate spring shows the following mineral ingredients:

CHALYBEATE SPRING (HARBIN HOT SPRINGS).

Sulphated-saline. Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	7.50
Sodium carbonate	14.22
Sodium bicarbonate	1.45
Sodium sulphate	5.25
Potassium chloride	Trace.
Potassium carbonate	1.73
Magnesium carbonate	4.16
Magnesium sulphate	6.11
Calcium carbonate	2.07
Calcium sulphate	Trace.
Ferrous carbonate	1.90
Alumina	0.73
Silica	1.41
Organic matter	Trace.
Total solids	46.53

Carbonic acid gas, 9.34 cubic inches.

This water is clear and sparkling, and has a pleasant taste. It is tonic, antacid, diuretic, and aperient, and is useful in dyspepsia, anæmia, chlorosis, chronic malarial poisoning, and wasting diseases. In addition there are two more important springs, known as the "Magnesia" and the "Arsenic" Springs. The last named spring has gained quite a reputation in syphilitic and skin diseases, glandular indurations, etc.

HIGHLAND SPRINGS,

LAKE COUNTY.

Post-office, Highland Springs. Hotel and cottages. These excellent springs are found within the edge of the mountains, about four miles from Kelseyville and seven miles from Lakeport. They are reached by the Southern Pacific R. R. on the south to Calistoga, and thence by stage; also by the Northern Pacific Road on the southwest to Cloverdale, and thence by stage. The drive from Calistoga or Cloverdale is exceedingly picturesque. The road leads through a romantic mountain region until an elevation of 3200 feet is gained. Here a grand panorama is revealed. As far as the eye can reach in every direction are mountains and valleys, peaks upon peaks, mountain streams and brooks, forest, and shrubbery. The most picturesque of all is the view northward over Clear Lake and Lake County. This is a magnificent sheet of water twenty-five miles long and six to eight miles wide. It has an elevation of 1200 feet above the Pacific Ocean, and lies peacefully smiling in the embrace of the mountains on every side with the towering head of "Uncle Sam" above them all. The bright cultivated fields appear like a checkerboard in the valley below. The gigantic oaks, the largest in the State, are scattered here and there to lend variety to the enchanting picture. The descent to the springs is made in much less than half the time it takes to make the ascent, and the resort is soon seen lying in a level sequestered spot surrounded by hills and by trees of many years' growth. At Highlands we find a commodious hotel and many elegant cottages built with a view to health and pleasure combined. A large, pure mountain stream, which is well supplied with fish, runs past the hotel. The usual mild, genial climate of Lake County prevails here. The altitude is about 1700 feet, and it is claimed to be an excellent place for consumptives. There are about twenty springs at Highlands, five of the most important having been examined by Anderson in 1888. These analyses show results practically identical with those of Professor Rising in 1882, except in the case of the "Neptune" Spring, which seems to have lost greatly, especially in calcium salt, in the course of six years.

The principal springs are the "Magic," the "Neptune," the "Seltzer," the "Dutch" or "Ems," and the "Diana" Springs. The waters are chiefly of the alkaline-saline type, most of them containing a well-marked proportion of iron. Following are analyses of two of the representative springs:

THE SELTZER SPRING.

Alkaline-chalybeate. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.67
Sodium carbonate	2.06
Sodium bicarbonate	12.72
Potassium bicarbonate	0.50
Magnesium bicarbonate	33.95
Calcium bicarbonate	52.25
Manganese bicarbonate	Trace.

One U. S. gallon contains:

Solids.	Grains.
Ferrous carbonate	1.43
Silica	5.13
Alumina	1.75
Organic matter	Trace.
Total solids	110.46

Free carbonic acid gas, 98.41 grains.
Temperature of water, 60.4° F.

The water is antacid, tonic, laxative, and diuretic, and has been used with much satisfaction in dyspepsia, neuralgia, kidney and bladder troubles, calculi, etc., and in rheumatism, gout, and skin diseases.

THE "DUTCH" OR "EMS" SPRINGS.

Alkaline-chalybeate. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	1.76
Sodium bicarbonate	17.50
Sodium carbonate	2.45
Potassium bicarbonate	0.78
Magnesium bicarbonate	66.55
Magnesium carbonate	1.63
Calcium bicarbonate	57.32
Manganese bicarbonate	Trace.
Ferrous carbonate	1.53
Silica	7.23
Alumina	0.12
Organic matter	Trace.
Total solids	156.86

Free carbonic acid gas, 85.90 grains.
Temperature of water, 77° F.

This water is more diuretic and laxative than the Seltzer. The Highland bathing water is artificially heated. It is also an alkaline-saline fluid with considerable carbonic acid gas and some iron. The baths are used for rheumatism and joint-affections.

HOT BORATE SPRING,

LAKE COUNTY.

This remarkable spring is situated near the town of Lakeport and on the edge of Clear Lake. The spring flows 18,000 gallons per hour, and has a temperature of 124° F. (July, 1888). On analysis it is found to contain the following mineral ingredients:

HOT BORATE SPRING.

Alkaline-saline. Borated and ammoniated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	86.82
Sodium bicarbonate	75.40
Sodium biborate	201.75
Potassium iodides	0.12
Potassium chloride	Trace.
Potassium bromide	"
Potassium bicarbonate	4.26
Ammonium bicarbonate	96.20
Magnesium bicarbonate	0.73
Calcium sulphate	Trace.
Alumina	2.04
Silica	7.96
Organic matter	9.07
Total solids	483.95

Free carbonic acid gas, 30.75 grains.

An analysis by Dr. Moore shows a much smaller percentage of borax—103 grains per gallon.

The spring is remarkable on account of the excessive amount of borax and ammonium salts which it contains. Professor Whitney states that the water is changeable both in its rate of flow and in its proportion of mineral ingredients. It is used in Lakeport and vicinity for kidney and bladder troubles. It is claimed that the water has dissolved a stone in the bladder.

HOT MUD SPRINGS,

SISKIYOU COUNTY.

Extensive hot mud beds and springs are found on the banks of Shovel Creek. The locality is filled with sulphurous fumes, and heavy incrustations of native sulphur deposits may be seen around the margins of the springs. A small resort has sprung up at this place, and chronic rheumatic and crippled invalids are said to improve while using the baths.

HOT SPRING ON PAOHA ISLAND IN MONO LAKE.

This spring has a temperature of 110° F. Although on a small island in the middle of Mono Lake, which contains 3000 grains of salt to the gallon, this spring has only 37.88 grains in a similar amount of water.

HOUGH'S MINERAL SPRINGS,

LAKE COUNTY.

These springs are pleasantly located on the north side of Cache Creek, about thirty-two miles from Williams, at an altitude above the sea-level of 1960 feet. The place is reached from San Francisco to Williams or Calistoga by rail, and thence by stage. The waters are all cold, having a temperature of 60° F.

No. 1, the main spring, contains magnesia, soda, silica, alumina, and ferruginous salts, with an excess of carbonic acid gas. The water is tonic, aperient, and diuretic.

No. 2 flows from an artificial well dug about twenty-five feet deep. It is strongly impregnated with iron and magnesia salts, and large draughts produce free evacuations.

No. 3, also a well, twenty-eight feet deep, contains some sulphur and is much used for cutaneous and rheumatic diseases.

No. 4 is a carbonated water. The resort is a pleasant one, and is gaining in public favor every year.

HOWARD SPRINGS,

LAKE COUNTY.

Post-office, Putah. Hotel and cottages. Access from San Francisco, Sacramento, or Woodland to Calistoga, thence by stage to the springs. These are some fourteen in number, and are picturesquely located in a mountainous pine region 2240 feet above the level of the sea. Following is a quantitative analysis of the principal springs by Professor W. T. Wenzell, California College of Pharmacy, San Francisco :

One U. S. gallon contains: Solids.	Excelsior Spring. No. 1. Grains.	The Twins Spring. No. 2. Grains.	Eureka Spring. No. 3. Grains.	Neptune Spring. No. 4. Grains.	Soda Spring. No. 5. Grains.
Sodium chloride . .	101.67	30.96	35.70	29.61	9.38
Potassium chloride .	1.13	19.71	25.65	14.64	12.81
Lithium chloride . .	8.35	0.03	0.09	0.06	. . .
Sodium bicarbonate .	34.10	73.97	82.35	. . .	37.72
Magnesium bicarbonate	2.81	114.10	110.25	73.34	59.32
Calcium bicarbonate .	6.30	10.88	5.84	32.14	35.64
Iron bicarbonate . .	1.85	1.14	. . .	. . .	. . .
Alumina . . .	0.03	0.15	0.10	0.19	0.13
Oxide of iron . .	. . .	. . .	4.95	0.20	0.09
Silica	13.10	9.24	3.40	8.34	6.95
Organic matter . .	0.14	0.32	0.20	0.25	0.26
Total . . .	156.84	260.50	268.53	158.77	152.28
	Cubic ins.	Cubic ins.	Cubic ins.	Cubic ins.	Cubic ins.
Free carbonic acid gas .	134.00	77.50	150.00	120.00	117.00
Temperature . .	75°	102°	110°	85°	60°

The " Excelsior Spring " is quite similar to some of the Saratoga springs of New York. It will be observed that the percentage of sodium chloride is much less than that of its namesake, the Saratoga Excelsior, while the amount of sodium bicarbonate is about twice as great. The water is mildly purgative, and on account of the large quantity of lithia which it contains is useful in a number of urinary complaints, especially calculus and gravel. The "Twins" No. 2, although only six feet apart, show a remarkable difference of temperature, one being cold at 50° F., the other thermal at 102° F. The water of the hot spring is a very effective purgative, and is used in habitual constipation, chronic dyspepsia, and in certain diseases of the liver and kidneys. Owing to the large quantity of iron contained in the "Eureka" spring (No. 3), it has gained great celebrity in the treatment of anæmia, debility, etc. The "Neptune" (No. 4) is also quite rich in iron, besides containing, as the analysis shows, considerable quantities of magnesia, lime, and soda. The water is tonic and mildly laxative in its action. The "Soda" Spring (No. 5), being very rich in carbonic acid gas, forms a pleasant, cooling, effervescent draught, if taken directly from the springs. It contains a little iron and has mild tonic properties.

KLAMATH HOT SPRINGS,

SISKIYOU COUNTY.

These springs are located on the Shasta Division of the Southern Pacific R. R., some eighteen miles from Ager. The resort is 2700 feet above the sea-level, and is surrounded by a wild and picturesque country with snow-capped mountain peaks and hills clad in evergreen forests. There are ample accommodations for invalids and guests, as well as excellent bathing facilities. The waters are alkaline-saline and sulphurous. Some of them are carbonated. The springs have already gained considerable celebrity in the treatment of chronic rheumatism, gout, synovitis, chronic cutaneous diseases, dyspepsia, etc.

LAKE TAHOE, or CARNELIAN HOT SPRINGS,

PLACER COUNTY.

These hot and cold mineral springs are located on Carnelian Bay, at the northern end of Lake Tahoe. They form part of the attractions of this famous inland sea. They are reached by rail to Truckee, and from thence by stage over a good mountain road in about two and one-half hours' drive. The scenery en route is grand. The Truckee River is crossed and recrossed, mountain sides and heights are scaled, and fertile valleys, on which graze immense herds of cattle, are traversed. Forests of beautiful pine and cedar rear themselves at intervals; humming saw-mills fill the air with life, and wild, romantic views greet the eye at every turn.

Lake Tahoe is a noble sheet of water, having an altitude of 6202 feet above the sea-level. It is divided by the California and Nevada State line, has a length of twenty-one miles, a width of twelve miles, and is 1645 feet in depth.

The appointments at the springs resort are very complete. Excellent bathing facilities have been provided, where all kinds of cold and hot sulphur baths may be taken. The springs are about fifty in number, and are well kept and cared for. The waters are sulphurous and saline, and a few are carbonated. They contain sodium chloride, calcium sulphate, silica, organic matter, magnesium sulphate, and free sulphureted hydrogen gas. The baths are used with success in rheumatic and gouty troubles, and the waters are taken internally for liver and kidney disorders, chronic constipation, and cutaneous diseases. The high altitude and invigorating mountain air recommend the location as a resort for broncho-pulmonary affections. There are excellent facilities for camping, hunting, and fishing in the vicinity.

LANE MINERAL SPRINGS,

Calaveras County.

These springs lie thirty-five miles east of Stockton. They are 1000 feet above the sea-level, and are surrounded by hills and valleys clad in forests of pine. The main spring flows from 50 to 75 gallons per hour. The following probably incorrectly reported analysis is said to have been made by the San Francisco Refining and Analytical Association :

LANE MINERAL SPRINGS.

Acid-chalybeate. Sulphureted.

One U. S. gallon contains :

Solids.	Grains.
Iron carbonate	122.00
Magnesium carbonate	38.51
Epsom carbonate (?)	29.76
Alumina	2.01
Sodium carbonate	8.52
Free sulphuric acid	15.24
Silica	15.20
Potassium carbonate	18.01
Organic matter	2.72
Total solids	251.97

Free sulphureted hydrogen gas, 105 cubic inches.

This water has been in use for several years, and is said to be beneficial in constipation, dyspepsia, chronic malarial poisoning, and in kidney and liver complaints.

LITTON SELTZER SPRINGS,

Sonoma County.

Post-office, Healdsburg. Hotel and cottages. These excellent seltzer and soda springs are located about four miles north of Healdsburg, on the line of the San Francisco and Northern Pacific R. R.

The springs and adjoining property—about 1000 acres—have been incorporated, and extensive buildings, in the way of hotels, cottages, bath-houses, etc., are contemplated. Some of the waters are used commercially. The water is slightly acid when first drawn, but by exposure it loses its carbonic anhydride and becomes alkaline. The following analysis was made some years ago by Dr. Winslow Anderson :

LITTON SELTZER SPRINGS.

Alkaline-saline. Aluminous. Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	79.34
Sodium bicarbonate	6.26
Sodium carbonate	72.73
Potassium carbonate	3.60
Magnesium bicarbonate	13.90
Magnesium sulphate	6.75
Calcium bicarbonate	14.05
Calcium sulphate	5.03
Ferrous carbonate	2.14
Alumina	6.81
Borates	4.43
Lithia	Trace.
Ammonia	0.33
Silica	8.09
Organic matter	Trace.
Total solids	223.46

Free carbonic acid gas, 375.60 grains.
Temperature, 62° F.

A previous analysis by Prof. Hanks showed 228.69 grains in solids and 383.75 grains in carbonic anhydride to the United States gallon. The temperature of the water is 62° F.

It is much used as an antacid in dyspepsia, and in uric-acid states. The water has aperient and diuretic properties.

MARK WEST SPRINGS,

SONOMA COUNTY.

Hotel and cottages. This resort is situated eight miles from Santa Rosa near the famous "Petrified Forest," on Mark West Creek. It is reached by rail to Calistoga or Santa Rosa, and thence by carriage or stage over a picturesque drive to the springs. The mountain region along the road is coming under a high state of cultivation, and beautiful villas and private mountain retreats are springing up in all directions. The springs are beautifully located at an elevation of 800 feet in a small valley formed by the junction of four canyons. The hotel and grounds are at the bases of three venerable mountains, known as Mt. Washington, Mt. Lincoln, and Mt. Grant. The air is clear and dry, the temperature ranging from 80° to 90° F., with cool, bracing sea breezes. There are excellent hotel accommodations and several cottages for family use. Hot sulphur and mud baths have been constructed with all facilities for the comfort of the visitor or invalid. There are several springs on the place, one of them, a sulphur spring, yielding about 200 gallons per hour. The temperature of the water is 82° F. It contains:

Sulphate of sodium.
Sulphate of magnesium.
Salts of potassium (trace).
Chloride of sodium.
Carbonate of sodium.
Carbonate of potassium.
Carbonate of lime.
Silica.
Alumina.
Free carbonic acid gas.
Sulphureted hydrogen gas.

There is also a strong chalybeate spring, yielding 600 gallons of water per hour, having a temperature of 65° F. The largest spring has a flow of 5000 gallons hourly; this is a sparkling carbonated water, very palatable, and gently aperient in its action. The water at these springs has been found useful in a considerable variety of affections. The baths are sulphurous.

MONO LAKE,

Mono County.

This remarkable body of water is located near the centre of Mono County, about ten miles south of the town of Bodie. The length of the lake from east to west is about fourteen miles, and its greatest breadth nine miles. Its altitude is 6370 feet above the sea-level.

In his article on the "Mineral and Thermal Springs of California," read before the Ninth International Medical Congress, Prof. W. F. McNutt likens this lake to the Dead Sea of the Holy Land. The analysis shows, however, that the waters of this lake (see below) are not so salt as those of the ancient Palestine sea. The lake receives much of its water and its salts from the rivers and creeks which flow through volcanic soil and empty into it. Numerous springs are found all over the lake. The most curious of these are some of the fresh-water springs, holding in solution small quantities of calcium carbonate, which precipitate and deposit around the opening of the springs, forming irregular tubes clustered together in columns. These vase-shaped structures are ten to forty feet long and rise from the bottom of the lake upward and above the surface. In the centre of these columnar pillars are small holes through which flows this sweet water. In Mono Lake we find several islands, some of them two or three miles in length. Their composition is of volcanic material, and all over the surface are hot springs and jets of hot steam, making the surrounding water quite warm. On several of these little islands are small craters, fifty or more feet in diameter. They are now filled with water. All around Mono Lake are unmistakable evidences of great volcanic activity during the tertiary and post-tertiary periods, and there are the best of reasons for believing that the lake itself is a large extinct crater. The water, being likened to the Dead Sea, was supposed to be destitute of life. There are found, however, numerous worm-like, minute organisms, plainly visible to the naked eye, in the water near the surface. The larvæ of these animals are thrown upon the shores of the lake by the waves, and there accumulate in large quantities. The scenery around Mono Lake is grand and impressive. Situated as it is at so high an elevation, and surrounded on all sides by snow-capped mountains, a picture is presented to which only a true artist could do justice.

The water is more like a bitter brine to the taste than a mineral water. Its action is exceedingly diuretic, even in small quantities. Several analyses of this water have been made. The following one by Dr. Winslow Anderson is, perhaps, the most complete and comprehensive:

MONO LAKE.

Muriated-saline. Calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	795.24
Sodium carbonate	26.40
Sodium sulphate	17.10
Sodium phosphate	5.93
Potassium chloride	281.17
Potassium carbonate	10.60
Potassium phosphate	3.05
Magnesium chloride	365.60
Magnesium carbonate	9.45
Magnesium sulphate	127.50
Calcium chloride	1075.55
Calcium carbonate	52.76
Calcium sulphide	Trace.
Calcium sulphate	57.07
Ferrous carbonate	7.14
Alumina	26.63
Borates	19.75
Silicates	9.62
Organic matter	24.60
Total solids	2915.16
Gases.	**Cubic inches.**
Free carbonic acid gas	17.16
Free sulphureted hydrogen	0.62

Temperature of water, 63° to 80° F.

The composition will probably vary somewhat in different localities, being influenced by the proximity of the various springs.

NAPA SODA SPRINGS,

NAPA COUNTY.

Post-office, Napa Soda Springs. Hotel and cottages. Access: Take Oakland Ferry (from San Francisco) at 8 A.M. for Napa City, forty-six miles distant, arriving at 10.10 A.M. Then take stage to springs, five miles distant. Spring, summer, and autumn, are suitable seasons for visiting the springs. The resort is charmingly located on the southwestern slope of the Coast Range, at an elevation of about 1000 feet above the level of the sea. From the Rotunda Hotel many beautiful views are spread before the eye in all directions. Looking southward over the beautiful valley of Napa County one sees a landscape seldom surpassed for loveliness, and which always remains fresh in the memory. The green fields, cultivated farms, orchards and vineyards, gardens and houses, checkered here and there in an irregular manner with straight and winding lanes, creeks and rivers, and groves of stately oaks, and in the distance the San Francisco Bay, glistening and rippling in the sun's rays, blend to make a harmonious whole, to which only the trained tongue or pen can do justice. To the westward may be seen the great Pacific, guarded by the sentinel, Mt. Tamalpais, and many ranges of mountains and hills. To the eastward Mt. Diablo looms up in the distance, half-veiled in violet mists. To the north we see Mt. St. Helena and the Coast Ranges with their rich alluvial valleys. The local picture of Napa Soda Springs is scarcely less interesting. We find groves of oaks gracefully festooned with immortal mistletoe, the tall and stately pine and the Eucalyptus globulus, lawns and flower beds, cultivated and natural, with many shady nooks and sylvan bowers—combined nature and art—producing as lovely a spot as the tired business man with his family, or the invalid with his many ailments, could possibly find. The climate is warm, dry, and salubrious, uniting the advantages of mountain air with breezes direct from the sea. The mineral springs here are among the most noted in the State. They number twenty-seven in all, with an average daily flow of about 4000 gallons. The temperature of the water ranges from 65° to 68° F. The main spring, the Pagoda, from which most of the commercial Napa soda is obtained, is an alkaline-chalybeate water strongly charged with carbonic anhydride. It is delightfully clear and sparkling, and has an agreeably pungent taste. Following is Dr. Anderson's analysis:

PAGODA SPRING (NAPA SODA SPRING).

Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	7.14
Sodium bicarbonate	12.95
Sodium carbonate	1.10

One U. S. gallon contains:

Solids.	Grains.
Sodium sulphate	1.62
Potassium bicarbonate	Trace.
Magnesium bicarbonate	3.04
Magnesium carbonate	21.76
Calcium bicarbonate	0.78
Calcium carbonate	9.55
Ferrous carbonate	7.90
Silica	0.74
Alumina	0.57
Organic matter	Trace.
Total solids	67.15

Free carbonic acid gas, 143.62 cubic inches.
Temperature of water, 67.7° F.

Over this spring a beautiful pagoda, supported by solid stone pillars, and resting upon a tessellated marble floor, a natural stone basin has been artistically arranged, through which sparkling soda bubbles in all its freshness.

There are many other important springs at Napa, including the well-known Iron Spring and the Lemon Spring. The former was analyzed by Prof. Lanzwurt in 1870, with the following result:

IRON SPRING (NAPA SODA SPRING).

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	5.20
Sodium bicarbonate	13.12
Sodium sulphate	1.84
Magnesium carbonate	26.12
Calcium carbonate	10.83
Ferrous carbonate	7.84
Silica	0.62
Alumina	0.60
Total solids	66.17

Free carbonic acid gas, undetermined.
Temperature, 68 F.

The waters of all the springs have the same general characters—alkaline-chalybeate, clear and sparkling. Napa soda water is highly esteemed as a beverage. It is sold in every city and town of the coast, and is one of the pleasantest summer drinks to be found. The water is an efficient aid to digestion, being antacid and tonic. When taken early in the morning before breakfast its action is gently aperient. The ferruginous salts held in solution by the carbonic acid gas are valuable in anæmia and chlorotic conditions, malarial toxæmia, and many disorders requiring iron for the constructive metamorphosis of red blood-corpuscles. Much benefit is derived from a course at the springs in Bright's disease and chronic cystitis, and in acid states of the blood and urine. The waters have also proved beneficial in the treatment of chronic and subacute metritis and ovaritis, and are said to be better borne by the stomach in these and the many varied uterine complications than almost any other chalybeate tonic.

The grounds at Napa Soda Springs cover over a thousand acres of hill and valley. The place is thoroughly improved, and the visitor will find every arrangement provided for his comfort and recreation while sojourning there. Among the attractive features should be mentioned the excellent bathing facilities, both tub and plunge. There is also a swimming bath measuring 150 feet in length by 50 feet in width, and with a depth of water varying from four to ten feet.

NEWSOM'S ARROYO GRANDE SPRINGS,

SAN LUIS OBISPO COUNTY.

Post-office, Arroyo Grande. Hotel and cottages. Access: By rail to Arroyo Grande, thence by stage two miles to springs. The ocean beach road affords one of the finest drives in that section of the country. The springs are pleasantly situated at an altitude of about 400 feet. They lie about fourteen miles south of San Luis Obispo. The climate here is one of almost perpetual sunshine, with occasional spring and fall rains. On the place are three principal springs whose waters range in temperature from 40° to 100° F., and flow 49,000 gallons hourly. The following analysis was made by Winslow Anderson:

NEWSOM'S ARROYO GRANDE SPRINGS.

Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	4.10
Sodium carbonate	1.75
Sodium sulphate	3.92
Potassium carbonate	0.15
Potassium sulphate	2.90
Magnesium carbonate	6.41
Magnesium sulphate	2.47
Calcium carbonate	8.25
Calcium sulphate	0.76
Ferrous carbonate	3.98
Alumina	0.33
Silica	2.03
Organic matter	0.27
Total solids	37.32

Gases.	Cubic inches.
Free carbonic acid gas	14.90
Free sulphureted hydrogen	3.56

Temperature of water analyzed, 100.5° F.[1]

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[1] An older analysis by an unknown analyst shows almost the same results.

These waters have gained considerable reputation in the treatment of old cases of chronic rheumatism and gout, catarrhal affections of the bladder and bowels, skin diseases, etc. For uterine disorders the hot sulphurous douche has been highly recommended.

OJAI HOT SULPHUR SPRINGS,

VENTURA COUNTY.

Access: *via* Southern Pacific R. R. to Ventura, thence fifteen miles by stage to springs. This resort is beautifully situated in Waterfall Canyon, about five miles from the thriving village of Nordhoff. The altitude of this location is about 1000 feet above the sea-level. The surrounding scenery is very fine, and the vicinity affords excellent hunting and fishing. The springs flow about 50,000 gallons per hour, and have a temperature ranging from 60° to 104° F. Several of the springs are carbonated, and others are sulphureted. Among the well-known springs are the Fountain of Life, St. Jacob's Well, and the Mother of Eve Springs. These Ojai waters contain the carbonates and sulphates of sodium, potassium, and magnesium, the carbonates of iron and lime, silicates, and carbonic acid and sulphureted hydrogen gases. Many stiff-jointed, rheumatic and gouty persons repair to these springs for relief, and it is stated that a fair percentage of them are not disappointed in their quest. Good accommodations are provided for visitors.

OWENS LAKE,

INYO COUNTY.

This second Dead Sea in California is located at the southern end of Owens Valley in Inyo County. It is eighteen miles long and ten miles wide. Its surface embraces 100 square miles. The waters are exceedingly rich in saline and alkaline ingredients. The following analysis was made by Prof. Phillips, of London, in 1883:

OWENS LAKE.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	2450.81
Sodium carbonate	797.01
Sodium sulphate	2427.69
Potassium sulphate	29.77
Potassium silicate	116.23
Organic matter	14.11
Total	5835.62

We are informed by Dr. I. J. Woodin, of Independence, Cal., that numerous fresh-water springs are found along the shores of the lake, some of which are cold and others boiling hot. At the southwest end of the lake there is a valuable white sulphur spring which has not so far been improved. At a short distance from this spring is a mountain formed in great part of sulphur, of which Dr. Woodin sends us a handsome specimen, composed probably almost entirely of the pure element. The aspect of the country is mountainous, the elevation of the lake being 3000 feet above the Pacific. The region offers many attractions as a health resort, and it will no doubt soon be developed.

PACIFIC CONGRESS SPRINGS,

SANTA CLARA COUNTY.

Post-office, Saratoga. Hotel and cottages. Access: Stages connect at Los Gatos with Southern Pacific trains leaving San Francisco morning and evening. Time, three hours and fifteen minutes. These springs obtain their name from their resemblance to the well-known Congress Spring at Saratoga, New York.

The Santa Clara Valley is celebrated for its excellent climate and dry, pure, and invigorating air. A large and commodious hotel and several cottages have been established at an elevation of 735 feet above the sea-level. The springs are located about one hundred feet further up the mountain side. The drives about these springs are among the finest in the State. There are several springs on the premises which flow in great profusion. The waters belong to the alkaline-chalybeate class. They are very valuable for table purposes. The following analysis was made by Anderson in 1888 :

PACIFIC CONGRESS SPRINGS.

Saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	115.76
Sodium carbonate	120.42
Sodium sulphate	12.95
Potassium carbonate	2.06
Magnesium carbonate	26.34
Magnesium sulphate	14.17
Calcium carbonate	16.03
Calcium sulphate	14.19
Ferrous carbonate	13.87
Alumina	4.50
Silica	3.98
Organic matter	Trace.
Total solids	334.27

Free carbonic acid gas, 44.17 cubic inches.
Temperature of water, 50° F.

It will be observed that this water is much less densely mineralized than is that of its New York namesake. The Saratoga Congress Spring contains over 700 grains of solid ingredients to the United States gallon, and over 392 cubic inches of carbonic acid gas. The California Congress waters are, however, much more strongly chalybeate than those of Saratoga. Their action is decidedly tonic from this large infusion of iron. They are also mildly aperient (from the presence of Glauber's and Epsom salts), diuretic, and antacid (from the presence of alkaline carbonates). The springs have gained considerable celebrity in the treatment of anæmia, dyspepsia, liver and kidney troubles, irritability of the bladder, rheumatism, gout, and cutaneous affections. The waters are shipped to all parts of the coast.

PARAISO HOT SPRINGS.

Post-office, Paraiso Springs. New cottages. Access: Take 8.15 A.M. Southern Pacific train from the corner of Third and Townsend Streets, San Francisco, reaching Soledad Station at 1.43 P.M. Thence by stage a drive of one hour and a half to the springs.

"Paraiso Springs," says Mr. E. S. Harrison, in his history of Monterey County, "were the property of the Mission Soledad, which lies about five miles northeast of the Springs. The title of the present owner was obtained from the Church of Rome, to which a patent was granted by the Mexican Government in 1778. In the records of the Mission Soledad the healing and invigorating qualities of these waters are duly set forth.

The springs are situated in a picturesque alcove of the Santa Lucia Mountains on the western border of the Salinas Valley, about 150 miles south of San Francisco. The altitude of the location, being nearly 1000 feet above the valley, renders the atmosphere dry, bracing, and invigorating. Below the resort and for miles beyond the eye scans the fertile valley, traversed by the grand Salinas River, and Arroyo Seco, and the far-away Gabilan Mountains, forming a picture of inexpressible charm and glory. The commodious hotel and cottages combine all the luxury and comforts with convenience and wholesomeness that can be found anywhere. On the premises are several valuable springs flowing about 2000 gallons of water per hour, consisting of sulphur, soda, and iron waters. The temperature of the springs varies from 100° to 118° F. The following analysis of the principal sulphur spring was made by Dr. Anderson in 1889:

SULPHUR SPRING (PARAISO SPRINGS).

Saline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	2.76
Sodium carbonate	1.15
Sodium sulphate	37.10
Potassium sulphate	0.83
Magnesium carbonate	6.09

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	2.19
Calcium carbonate	0.89
Calcium sulphate	4.40
Ferrous oxide	0.73
Silica	2.55
Organic matter	7.35
Total solids	66.04
Gases.	**Cubic inches.**
Carbonic acid gas	2.04
Sulphureted hydrogen	9.25

Temperature, 114° F.

This is said to be one of the best bathing waters on the coast.

THE GREAT PARAISO HOT SODA SPRING.

Sulphated-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	3.37
Sodium carbonate	5.06
Sodium sulphate	34.60
Potassium chloride	0.32
Potassium sulphate	Trace.
Magnesium carbonate	0.75
Magnesium sulphate	1.10
Calcium carbonate	1.30
Calcium sulphate	6.45
Ferrous carbonate	0.89
Alumina	0.56
Silica	2.90
Organic matter	4.15
Total solids	61.45

Free carbonic acid gas, 2.95 cubic inches.
Temperature of water, 118° F.

Qualitatively this water closely resembles the famous Carlsbad sprudel water, but is less highly mineralized. Thousands of visitors, invalids, and pleasure-seekers visit Paraiso Springs yearly, and the excellence of the mineral waters, the salubrity of the climate, and the picturesqueness of the location bid fair to make Paraiso one of the most prominent mineral health resorts on the coast.

PIEDMONT WHITE SULPHUR SPRINGS,

ALAMEDA COUNTY.

These springs are located three miles from Oakland, and have gained considerable local reputation in the treatment of rheumatism, jaundice, liver and kidney troubles, and disorders of the stomach. There is a well-kept hotel with pleasant grounds at the place, and its nearness to San Francisco makes it available for residents of that city as a day resort. The situation on the western slope of the

Berkeley Hills commands a most picturesque view over the San Francisco Bay and the Golden Gate. The following analysis by Winslow Anderson shows the mineral ingredients of two of the springs:

One U. S. gallon contains: Solids.	The Iron Spring. Grains.	The Sulphur Spring. Grains.
Sodium chloride	5.10	7.91
Sodium bicarbonate	11.70	9.40
Sodium carbonate	0.52	6.20
Potassium carbonate	3.15	0.76
Potassium iodide	Trace.	Trace.
Magnesium carbonate	6.37	3.17
Magnesium sulphate	1.03	17.80
Calcium carbonate	2.13	3.32
Calcium sulphate	1.60	7.09
Ferrous carbonate	1.73	Trace.
Alumina	0.45	"
Borates	5.23	1.90
Silicates	4.19	5.06
Organic matter	Trace.	Trace.
Total solids	43.20	62.61
Gases.	Cubic inches.	Cubic inches.
Carbonic acid gas	7.25	4.60
Sulphureted hydrogen	Trace.	9.25
Temperature of water	58°	60°

These analyses show that the waters are valuable as a tonic, antacid, diuretic, and aperient; they are useful in dyspepsia, constipation, anæmia, rheumatism, and liver and kidney troubles.

SAN BERNARDINO HOT SPRINGS,

San Bernardino County.

These springs are fourteen miles from Arrow-head Hot Springs. They are picturesquely located at an elevation of 1600 feet above the sea-level. The springs vary in temperature from 100° to 175°. The waters have acquired considerable reputation in the surrounding district. The following analysis was made by Prof. Oscar Loew:

SAN BERNARDINO HOT SPRINGS.

Sulphated-saline.

One U. S. gallon contains:	Grains.
Sodium chloride	7.46
Sodium sulphate	47.63
Potassium sulphate	1.34
Magnesium carbonate	Trace.
Calcium carbonate	6.23
Ferrous carbonate	Trace.
Silica	11.95
Total solids	74.61

It will be observed that the waters are saline and calcic.

SANTA BARBARA HOT SPRINGS,

SANTA BARBARA COUNTY.

Post-office, Santa Barbara. Hotel and cottages. These famous hot sulphurous and soda springs are situated in the beautiful Santa Ynes Mountains, six and a half miles northeast of Santa Barbara City. The location is 1450 feet above the sea-level, and unites many advantages of climate and scenery. The resort suffered from unwarranted neglect for a time, but we are informed that a large and commodious hotel and a spacious pagoda bath-house, with stained-glass windows, and all modern facilities for health and comfort, have recently been erected.

The springs are twenty-two in number, and range in temperature from 99° to 122° F. Analyses have been made by Oscar Loew and Winslow Anderson. We present Anderson's analysis as more recent and more complete than that of Loew:

SANTA BARBARA HOT SPRINGS.

Alkaline-saline. Sulpho-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	1.74
Sodium carbonate	2.17
Sodium sulphate	14.92
Magnesium sulphate	7.75
Calcium sulphate	6.03
Aluminum sulphate	2.90
Arsenic	Trace.
Silica	1.18
Sulphuric acid	Trace.
Organic matter	"
Total solids	36.69

Gases.	Cubic inches.
Free carbonic acid gas	19.14
Sulphureted hydrogen	9.16

Loew's analysis shows a slightly greater proportion of solid ingredients. It will be observed that the waters resemble those of the Arkansas Hot Springs.

They have been found useful in the treatment of rheumatism, gout, and other joint affections, Bright's disease, and bladder irritation.

Excellent results have been observed from the use of the baths in syphilitic and scrofulous contaminations, glandular enlargements, and chronic skin diseases.

SANTA ROSA WHITE SULPHUR SPRINGS,

SONOMA COUNTY.

These springs are pleasantly situated about two miles from the town of Santa Rosa. The surrounding country is delightful in character and the climate very genial. There are good accommodations for visitors, and the resort is prosperous and thriving.

The springs are mostly sulphureted and cold, having temperatures ranging from 59° to 62° F. The principal spring was found by Anderson to have the following composition :

SANTA ROSA WHITE SULPHUR SPRINGS.

Light saline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	5.72
Sodium carbonate	2.19
Sodium sulphate	6.90
Potassium carbonate	0.63
Magnesium carbonate	0.75
Magnesium sulphate	9.07
Calcium carbonate	Trace.
Calcium sulphate	1.40
Ferrous carbonate	Trace.
Alumina	0.93
Borates	Trace.
Silica	1.16
Organic matter	Trace.
Total solids	28.75
Gases.	**Cubic inches.**
Free carbonic acid gas	4.16
Free sulphureted hydrogen	6.47

The action of this water is slightly aperient and diuretic. It is useful in congestion of the liver due to malarial poisoning, and in rheumatism, kidney and bladder troubles, and skin diseases. Excellent bathing facilities have recently been provided, the water being artificially heated.

SANTA YSABEL SULPHUR SPRINGS,

San Luis Obispo County.

Hotel and cottages. These valuable springs are located two and a half miles southeast of Paso Robles, on the line of the Southern Pacific Railroad, by which they may be reached. The location is a very delightful one, being in a small canyon about one mile east of the Salinas River. It is surrounded on all sides by the rolling hills covered with groves of gigantic oaks, towering pines, and clustering manzanitas. The atmosphere is sweet and balmy, and ranges from about 60° to 75° F. all the year round. The elevation is 1000 feet above the sea-level, and the distance from the coast is about thirty miles. The soil of the neighboring land is exceedingly fertile, producing almost every known variety of fruit, as ascertained from the United States Experimental Station, close by.

The main warm sulphur spring flows 20,000 gallons per hour.

The waters are clear and sparkling, lightly sulphureted and freely carbonated. The following analysis of three of the springs was made by Winslow Anderson in 1888:

SANTA YSABEL SULPHUR SPRINGS.

One U. S. gallon contains:	Main Warm Sulphur Spring.	Cold Sulphur Springs. (No. 1.)	(No. 2.)
Solids.	Grains.	Grains.	Grains.
Sodium chloride	18.10	11.47	11.50
Sodium carbonate	6.91	13.16	13.09
Sodium bicarbonate	29.04	...	...
Sodium sulphate	7.25	5.10	5.07
Sodium iodide	Trace.	Trace.	Trace.
Potassium bromide	"	"	"
Potassium iodide	"	"	"
Potassium chloride	"	...	...
Potassium carbonate	0.83	...	...
Magnesium carbonate	6.16	7.41	7.37
Magnesium sulphate	4.85	4.05	4.00
Calcium carbonate	2.45	1.09	1.06
Calcium sulphate	2.32	2.90	2.95
Manganese carbonate	0.13	0.34	0.35
Ferrous carbonate	0.98	0.25	0.26
Borates	Trace.	...	...
Alumina	0.73	0.83	0.84
Barium salts	Trace.	...	...
Silica	1.68	1.17	1.20
Organic matter	Trace.	Trace.	Trace.
Total solids	81.43	47.78	47.69
Gases.	Cubic inches.	Cubic inches.	Cubic inches.
Free sulphureted hydrogen	4.65	3.24	3.25
Free carbonic acid gas	11.75	11.41	11.30
Temperature of water	96.3°	59°	59.2°

The waters are tonic, antacid, diuretic, aperient, and sedative. The cold springs, being less densely impregnated with mineral ingredients, possess these qualities in a lighter degree than the warm. The waters have been found highly useful in a wide range of affections, embracing disorders of the liver, stomach, and bowels, catarrhal affections of the kidneys, chronic rheumatism, glandular indurations, obstinate syphilitic infection, and chronic cutaneous diseases. There are other valuable springs on the property, including a Warm Sulphur Mud Spring, which contains the following mineral ingredients, estimated in grains per United States gallon:

Solids.	Grains.
Sodium chloride	17.10
Sodium bicarbonate	27.04
Sodium carbonate	7.06
Sodium sulphate	7.25
Sodium iodide	Trace.
Potassium iodide	"
Potassium bromide	"
Potassium chloride	"

Solids.	Grains.
Potassium carbonate	0.43
Magnesium carbonate	5.73
Magnesium sulphate	3.94
Calcium carbonate	2.45
Calcium sulphate	2.35
Manganese carbonate	0.36
Ferrous carbonate	0.63
Alumina	0.65
Borates	Trace.
Barium carbonate	"
Silica	6.32
Organic matter	0.76
Total solids	82.07
Gases.	**Cubic inches.**
Free sulphureted hydrogen	4.71
Free carbonic acid	7.10

Temperature of mud, 95° F.

This hot sulphurous mud is excellently adapted for bathing purposes. Extensive improvements are under way at this resort. Good roads and building sites have been laid out, and a depot landing selected. A large mountain lake is in course of construction, which will be from 800 to 1000 feet long by several hundred feet broad. On its waters will be several pleasure boats. About one hundred feet above the lake, on a pleasant plateau commanding magnificent views of the Salinas Valley, a spacious modern hotel and a number of cosey cottages will be reared. Thorough bathing facilities will also be provided. With its natural advantages of climate, soil, and surroundings Santa Ysabel Resort promises to be one of the pleasantest inland watering places in that section of the country. It will be under the patronage of the Presbyterian Church.

SEIGLER'S SPRINGS,

LAKE COUNTY.

Hotel. These springs are located at the foot of Seigler Mountain, at an elevation of 2372 feet above the sea. They are in the neighborhood of Adams and Bonanza Springs, and lie in Seigler Valley, which is about one and a half miles long by half a mile in width. The surrounding country affords many excellent drives, and magnificent views are encountered on every hand. There are twenty or more springs, which yield approximately 3000 gallons per hour. The "Arsenic" Spring has a temperature of 96° F., and is much used for syphilis, scrofula, and cutaneous diseases. The "Soda" Spring is alkaline and carbonated, and forms a delicious drinking-water. It has been much in vogue for Bright's disease, bladder troubles, etc. The "Magnesia" Spring is heavily charged with Epsom salts and carbonic acid gas. A glassful before breakfast insures an easy and painless evacuation of the bowels. The

Sulphur Spring is mostly used for bathing and for lung, liver, and rheumatic troubles. There are very good accommodations at the springs.

SKAGG'S HOT SPRINGS,

SONOMA COUNTY.

Post-office, Skagg's Springs. Hotel and cottages. Access from Tiburon Ferry, San Francisco, 7.40 A.M. and 3.30 P.M., arrive at Geyserville and connect with stage for springs at 11 A.M. and 7 P.M. Connections from Sacramento by Carquinez and Santa Rosa R. R. to Santa Rosa, thence *via* San Francisco and Northern Pacific R. R. to Geyserville. Skagg's Hot Springs are pleasantly located in the Coast Range Mountains, in a picturesque spot, nine miles west of Geyserville and twenty miles east of the coast. The surrounding mountains are clothed with every variety of California verdure, and abound with trout streams. Many varieties of game are also found, including bear, deer, grouse, and quail. We are informed that a new road from the springs to the coast has recently been constructed, making accessible the Gualalla River, a widely celebrated trout-fishing stream. The springs, four in number, yield 15 gallons of water per minute, having a temperature of about 120° to 140° F., and a somewhat pungent, agreeably alkaline taste. Excellent bathing facilities have been provided. Analyses have been made by Prof. Eugene W. Hilgard and Dr. Winslow Anderson, which show no material difference in their results :

SKAGG'S HOT SPRINGS.

Carbonated. Borated.

One U. S. gallon contains : Solids.	Anderson's analysis. Grains.	Hilgard's analysis. Grains.
Sodium chloride	5.54	5.90
Sodium bicarbonate	159.03	161.27
Sodium biborate	24.19	26.47
Sodium iodide	0.13	Trace.
Potassium chloride	0.34	0.20
Potassium sulphate	0.94	0.26
Potassium iodide	Trace.	. . .
Magnesium carbonate	11.46	11.11
Magnesium sulphate	1.27	. . .
Calcium carbonate	3.75	2.20
Ferrous carbonate	0.62	0.05
Barium carbonate	0.25	0.24
Lithium carbonate	Trace.	0.06
Strontium carbonate	"	0.02
Alumina	"	Trace.
Silica	8.83	7.02
Organic matter	Trace.	. . .
Total solids	216.35	214.80

Free carbonic acid gas, 124 cubic inches. Not determined.

The waters here are very useful in rheumatism, neuralgia, sciatica, etc., as well as in affections involving the bladder and kidneys. They are highly recommended by medical men on the coast, and the proprietor has determined to keep the resort open all the year.

ST. HELENA WHITE SULPHUR SPRINGS,

NAPA COUNTY.

Post-office, St. Helena. Hotel and cottages. Access: Take ferry from San Francisco, foot of Market Street, at 8 A.M. and 4 P.M. Arrive at St. Helena *via* Calistoga train at 11.03 A.M. and 7.08 P.M. Take stage to springs, two miles distant.

This beautiful summer resort is located in one of California's loveliest valleys. The neighboring mountain sides are covered with forests, shrubbery, ferns, and wild flowers of every description. Brooks and cascades are seen on every hand. The grand old California redwoods, which are found here in great abundance, are alone worth a visit to this region. The mineral springs are numerous and valuable, and chiefly of the saline-chalybeate type. Mr. Sanford Johnson, the proprietor, furnishes us with the following analysis of three of the springs:

ST. HELENA WHITE SULPHUR SPRINGS.

Saline-sulphureted.

One U. S. gallon contains: Solids.	Spring No. 2. Grains.	Spring No. 6. Grains.	Spring No. 7. Grains.
Carbonate of iron	1.25	2.44	5.56
Carbonate of magnesium	0.62	0.56	4.36
Sulphate of sodium	8.26	11.33	12.84
Chloride of sodium	21.72	23 41	14.23
Chloride of calcium	1.32	0.86	0.78
Chloride of magnesium	0.87	2.22	0.65
Sulphides of sodium and calcium	2.65	1.85	1.62
Total solids	36.69	42.67	40.04
Gase.	Cubic inches.	Cubic inches.	
Sulphureted hydrogen	6.15	4.25	Trace.

There are six other springs which have not been completely analyzed. The waters vary in temperature from 64.4° to 97.25° F. The analysis shows them to possess valuable tonic properties. They are said to have considerable value in rheumatism and kidney affections.

SUMMIT SODA SPRINGS,

PLACER COUNTY.

Post-office, Summit Soda Springs. Hotel and cottages. Access *via* Central Pacific R. R. to Summit Station, thence by stage or carriage twelve miles to the springs. The location is near the summit of the Sierra Nevada Mountains, at an altitude of 6000 feet above the sea-level. The region is one of picturesque grandeur, and the magnificent view from the neighborhood of the springs is unobstructed for miles around. The air is pure, dry, and invigorating, being cool and pleasant all the summer. The springs are situated in an expansion at the head of a deep canyon along which winds one of the forks of the American River. The hotels and cottages are pleasantly located, and good bathing facilities are at hand. Two analyses have been made, which we submit :

SUMMIT SODA SPRINGS.

Alkaline-saline-chalybeate.

One U. S. gallon contains: Solids.	Dr. Winslow Anderson, 1888. Grains.	J. T. Randolph, 1878. Grains.
Sodium chloride	26.18	26.22
Sodium bicarbonate	4.11	. . .
Sodium carbonate	5.75	9.50
Potassium carbonate	0.82	Trace.
Magnesium carbonate	4.05	4.20
Calcium bicarbonate	38.93	43.20
Calcium carbonate	6.55	. . .
Ferrous oxide	. . .	1.75
Ferrous carbonate	2.70	. . .
Borates	Trace.	. . .
Alumina	1.13	1.75
Silica	1.94	2.06
Organic matter	Trace.	. . .
Total solids	92.16	88.68

Free carbonic acid gas, 187.25 cubic inches (saturated).

The water has antacid, diuretic, aperient, and tonic properties, and is useful in the treatment of dyspepsia, torpidity of the liver and bowels, Bright's disease, stone in the bladder, etc.

THERMAL ACID SPRINGS,

INYO COUNTY.

These remarkable springs are found in the Caso Range, twelve miles east of Little Owens Lake, and sixteen miles southeast of Olamoha. The country for miles around the springs is rich in pure crystallized sulphur, having, no doubt, been ejected by the sulphurous steam in the form of sulphurous anhydride (SO_2). On being exposed to the air the sulphur was deposited pure and water liberated.

This seems to be a rational explanation of the formation of these large sulphur banks. The water now flows through the small crevices and fissures, accompanied by sulphurous steam and vapors in rather limited quantities. The following analysis of the waters has been made by a chemist whose name has been lost:

THERMAL ACID SPRINGS.

Heavy acid-chalybeate. Saline. Aluminous.

One U. S. gallon contains:	Grains.
Sodium sulphate	145.75
Potassium sulphate	880.33
Magnesium sulphate	891.91
Calcium sulphate	69.96
Aluminum sulphate (?)	7404.41
Ferric sulphate (?)	1934.56
Sulphuric acid (?)	4670.72
Nitric acid	Trace.
Chlorine	"
Ammonia	"
Lithium	"
Total solids	15,997.64

In Anderson's work on the mineral springs of California the above analysis is stated in parts per 1000. Its correctness cannot be vouched for.

This acid sulphate water does not seem to have come into much use as yet. Well diluted and properly administered, it ought to be valuable in many conditions requiring tonic and astringent remedies. It will be observed that the water closely resembles that of the Matchless Mineral Wells of Butler County, Alabama, being, however, according to the above analysis, much stronger.

TOLENAS SPRINGS,

SOLANO COUNTY.

These well-known springs are located about five miles north of the town of Suisun in Solano County, adjoining the famous Tolenas onyx quarries. They are reached by rail from San Francisco or Sacramento to Suisun, and thence by stage over a good level road. The resort is 1253 feet above the sea, and is pleasantly located. On a clear day the State Capitol, Suisun Bay and Valley, and many other points of interest are easily seen. There are nineteen springs in all at Tolenas, flowing between 600 and 700 gallons per hour. The temperature of the water varies from 60° to 65° F. The springs have had a local reputation for over thirty years, and of late the water has been bottled and sold extensively all over the State. The resort is at this time in a very flourishing condition. Two analyses have been made, one by J. Hewston, Jr., the other by Dr. Winslow Anderson. They show no important differences in their results. Following is Anderson's analysis:

TOLENAS SPRINGS.

Alkaline-saline. Borated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	194.16
Sodium carbonate	46.93
Sodium bicarbonate	6.45
Sodium biborate	19.13
Potassium chloride	6.47
Potassium iodide	1.75
Magnesium carbonate	11.58
Calcium carbonate	49.80
Ferrous carbonate	0.89
Alumina	1.10
Silicates	1.92
Organic matter	Trace.
Total solids	340.18

Free carbonic acid gas, 31.27 cubic inches.
Temperature of water, 61.5° F.

Hewston's analysis shows 360 grains of solid matter to the gallon. The water is warmly indorsed by many who have used it. In chronic skin affections, eczema, scrofula, and syphilitic contaminations it seems to act well. Chronic gastric disturbances, kidney and bladder diseases also improve under its use. The water is gently aperient and strongly diuretic.

TUSCAN (or LICK) SPRINGS,

TEHAMA COUNTY.

Post-office, Red Bluff. Hotels and cottages. The Tuscan Springs, about fifty in number, are located about eight miles northwest of Red Bluff, 200 miles north of San Francisco, and 135 miles north of Sacramento. They cover an area of about ten acres, and are situated at an elevation of 900 feet above the sea level. No complete analysis seems to have been made, but the waters resemble in medicinal properties those of the Kentucky Blue Lick Springs. A partial analysis of the Red Spring was made by Dr. F. W. Hatch, a number of years ago. It contains:

Sulphuric acid.[1]
Hydrochloric acid.
Lime.
Sodium chloride (20.72 grs. per U. S. gallon).
Lithia.
Iodine (4.50 grs. per U. S. gallon).
Carbonic acid.
Iron bicarbonate.
Potassium chloride.
Magnesia.
Alumina.

Temperature of water, 78° to 80° F.

The White and Black Springs are also in use, but they have not been analyzed. Most, if not all, of the springs contain sulphureted hydrogen in considerable quantities. The temperature of the springs varies from 67° to 94° F. Their action is tonic and alterative, laxative or cathartic, according to the amount taken. Ample facilities for bathing are furnished to guests. There is also a plunge bath thirty by sixty feet, four feet deep at one end, and thirteen feet at the other. The waters have considerable reputation on the Pacific coast in the treatment of syphilitic skin affections, scrofula, rheumatism, liver and kidney troubles. They are used commercially, having a considerable sale on the coast.

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[1] Probably in combination.—J. K. C.

UKIAH VICHY SPRINGS,

MENDOCINO COUNTY.

Access *via* San Francisco and Northern Pacific R. R. to Ukiah, thence a drive of three miles to the springs.

This pleasant resort, otherwise known as Doolan's Vichy Springs, lies nestled among enchanting hills which fringe the boundary line of Lake and Mendocino Counties. This region has a combination of advantages which make it a natural sanitarium. From April to November the climate is delightfully balmy and the atmosphere is pure, clear, and invigorating. The scenery is of a pleasing and attractive character, and the neighborhood of the springs affords excellent fishing and gunning. The waters belong to the alkaline-carbonated class, and are clear and sparkling, with an agreeably pungent taste. Their chemical composition closely resembles that of the celebrated Vichy Springs of France, and their physiological action on the human economy is practically identical with that exercised by those waters. Following is Anderson's analysis :

UKIAH VICHY SPRINGS.

Alkaline-saline. Carbonated.

One U. S. gallon contains :

Solids.	Grains.
Sodium chloride	28.60
Sodium carbonate	195.52
Sodium sulphate	0.36
Sodium phosphate	. . .
Potassium chloride	0.09
Potassium carbonate	Trace.
Potassium sulphate	"
Magnesium carbonate	19.75
Calcium carbonate	18.14
Ferrous carbonate	0.07
Strontium carbonate	. . .
Barium carbonate	. . .
Lithium carbonate	. . .
Borates	Trace.
Arseniates	. . .
Aluminates	Trace.
Silica	5.92
Total solids	268.45

Carbonic acid gas, 224.75 cubic inches.
Temperature of water, 93° F.

The French Vichy contains 311.88 grains per United States gallon. As an antacid, tonic, aperient, diuretic, and alterative mineral water the Ukiah Vichy ranks among the best in the country. It has proved highly beneficial in irritable states of the gastro-intestinal mucous membrane, dyspepsia, torpidity of the bowels, sluggish action of the liver, etc. Excellent results have also been observed in Bright's disease, acid states of the blood and urine, rheumatism, and gout. The waters are soon to be used commercially.

There are numerous other springs on the premises which have not been analyzed. Good accommodations and bathing facilities are provided for visitors.

UPPER SODA SPRINGS,

Siskyou County.

Hotel. These excellent springs are situated on the line of the Shasta scenic route of the Southern Pacific R. R , at an elevation of 2363 feet above the sea-level. The location is in Sacramento Canyon, and is picturesquely surrounded by immense forests of pine, fir, spruce, cedar, etc., interspersed by romantic mountain streams. The walls of the canyon are almost perpendicular. Here and there are enormous granite shafts rising hundreds of feet into the air. The majestic Mt. Shasta, with its snow-capped apex keeps eternal watch over the whole.

At the springs is a quiet, spacious, old-fashioned hotel with wide verandas and an air of solid home-like comfort. The waters are of the alkaline-carbonated class and are exceedingly palatable and wholesome. They contain chlorides of sodium and potassium, carbonates and bicarbonates of sodium, magnesium, potassium, iron, calcium, sulphates of sodium and magnesium, and a large quantity of free carbonic acid gas. The water is aperient, diuretic, tonic, and antacid It is highly recommended in the treatment of the uric-acid diathesis, gravel, and calculi, and irritative states of bladder and kidneys. The water is also of value in acid dyspepsia and flatulence.

VOLCANIC MINERAL SPRINGS,

Inyo County.

In Death's Valley are located several remarkable springs. One of these was analyzed by Prof. Price several years ago and found to contain over 4000 grains of solids per gallon. The water is chlorinated and alkaline, and contains presumably both sulphureted hydrogen and carbonic acid gas. Following is the analysis:

VOLCANIC MINERAL SPRINGS.

Muriated and Sulphated Saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	1840.72
Sodium carbonate	1724.11
Sodium sulphate	651.02
Sodium sulphide	46.34
Potassium chloride	132.30
Magnesia and lime	Traces.
Silica	14.28
Organic matter	13.48
Iodine	Traces.
Bromine	"
Iron	"
Boric acid	"
Phosphoric acid	"
Total solids	4422.25

Gases not determined.

The water is not used to any extent. There are other volcanic springs near Volcanic Station on the line of the Southern Pacific R. R. in San Diego County. The waters are reported to be sulphurous in character, but as far as we can learn they are not employed medicinally as yet.

WARNER'S RANCHE SPRINGS,

SAN DIEGO COUNTY.

These springs are located about thirty miles from San Diego. They are also spoken of by the Spanish as Aguas Calientes, but are not identical with the springs described under that head. The flow of Warner's Springs is about 1500 gallons per hour, and the temperature of the springs varies from 74° to 142° F. The waters are of the saline-sulphureted class, and are much used by the inhabitants of the surrounding country. They have a great local reputation in the treatment of syphilis and chronic skin diseases. A pleasant little resort is now established there.

WILBUR SPRINGS,

COLUSA COUNTY.

These mineral springs are located thirty miles from Colusa. They are pleasantly situated and have acquired considerable reputation. The waters are hot and sulphureted, and, according to Anderson's analysis, one United States gallon contains:

Solids.	Grains.
Sodium chloride	19.75
Sodium carbonate	3.40
Sodium sulphate	26.19
Potassium chloride	0.46
Silicates	6.95
Magnesium sulphate	22.90
Magnesium carbonate	5.10
Calcium carbonate	8.44
Calcium sulphate	20.62
Ferrous sulphate	4.16
Alumina	3.93
Potassium iodide	0.75
Organic matter	1.74
Total solids	124.39

Sulphureted hydrogen gas, 43.97 cubic inches.

A hotel and cottages have been built, and there are also excellent camping facilities.

WITTER'S MINERAL SPRINGS,

LAKE COUNTY.

These springs are pleasantly located about one mile east of Pearson's Springs, five miles from Upper Lake, and three miles from Blue Lake. The altitude is 1800 feet. The resort is a growing one, and is very picturesquely located, having excellent views of the lakes, valleys, and mountains in the vicinity. There are a good hotel, several cottages, and fine bathing facilities for hot and cold mineral baths. The springs are all cold and flow about 60 gallons an hour. There are cold soda and iron springs and cold sulphur springs. The principal spring is composed as follows :

WITTER'S MINERAL SPRINGS.

Saline-chalybeate. Sulphureted.

One U. S gallon contains :

Solids.	Grains.
Sodium chloride	17.42
Sodium carbonate	5.96
Sodium sulphate	11.50
Potassium carbonate	3.15
Magnesium carbonate	7.10
Magnesium sulphate	20.62
Ferrous carbonate	1.17
Manganese carbonate	0.86
Alumina	1.65
Borates	0.42
Silica	6.33
Organic matter	0.76
Total solids	76.94

Gases.	Cubic inches.
Carbonic acid gas	7.65
Sulphureted hydrogen	5.25

Temperature of water, 59.3° F.

This spring has received the very emphatic if not euphonious title of Dead Shot Spring, having reference to the action of the water on the diseases for which it is recommended. The water is said to be highly efficacious in liver, kidney, and bowel disorders.

YOUNG'S NATURAL GAS WELL AND MINERAL SPRINGS,

Lake County.

These natural wonders are located in the eastern edge of Kelseyville on a slightly elevated ground, about three miles south of Clear Lake and near the base of Uncle Sam Mountain. The well is so far more of a curiosity than a health resort. While boring for gas, in 1888, the proprietors were met at a depth of about 158 feet by a large volume of water and gas rushing out with great force. This has continued to flow, geyser-fashion, ever since. For an instant it stops, and then comes another violent ejection to the height of about forty feet; this occurs seventy or eighty times to the minute. The flow is about 6000 gallons of water per hour, having a temperature of 76° F. Many people from various localities visit the place to witness the peculiar phenomenon. The water has been extensively used by the people of Kelseyville and vicinity, who pronounce it excellent for liver, kidney, and bowel disorders. The following analysis of the water was made by Winslow Anderson in 1889:

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	15.76
Sodium carbonate	36.52
Sodium sulphate	19.16
Potassium carbonate	3.40
Potassium iodide	0.78
Magnesium carbonate	7.14
Magnesium sulphate	21.90
Calcium carbonate	6.36
Calcium sulphate	9.72
Manganese carbonate	0.18
Ferrous carbonate	4.95
Barium carbonate	Trace.
Lithium carbonate	"
Borates	3.12
Alumina	5.18
Silicates	6.45
Organic matter	Trace.
Total solids	140.62

Free carbonic acid gas, 9.60 cubic inches.
Petroleum and carbureted hydrogen (inflammable gas), traces.

The water may be described as a fairly strong saline-chalybeate. If sufficiently palatable it ought to have valuable therapeutic properties. Its action is tonic, antacid, aperient, and diuretic. It is the owner's intention to establish a health and pleasure resort on the premises. Several inflammable gas wells are also found on the ground. These yield a gas composed largely of light carbureted hydrogen.

ZEM ZEM SPRINGS,

LAKE COUNTY.

These springs are located on the southeastern side of Clear Lake, and take their name from the Holy Well in Mecca. The waters have a temperature of 64° F., and, according to an analysis said to have been made by Dr. Boon, contain the following ingredients :

One U. S. gallon contains :	Grains.
Sulphur	291.15
Iron	157.50
Magnesia	163.24
Solid matter	612.15
Total solids	1224.04

They have some notoriety in the treatment of dyspepsia and rheumatism and diseases of the liver and kidneys.

There are numerous other springs in California, which for convenience may be divided into three classes :

1. Those used as resorts, or whose waters are used commercially, but of which no analysis has been made or of which no account can be obtained for publication.

2. Those which are so far undeveloped. These constitute the far greater class.

3. Those which have once been used but for various reasons are now abandoned. This class embraces but few localities.

Of these three classes it seems proper to mention a few of the more prominent of the first subdivision only :

The Anti-Fat Springs, near Temescal, San Bernardino County.
Bear Valley Hot Springs, San Bernardino County.
Benton Hot Springs, Mono County.
Blank's Hot Sulphur Springs, Colusa County.
Branhick's Boiling Springs, Lassen County.
Campbell's Hot Springs, Sierra County.
Cold Soda Springs, Tuolumne County.
Cook's Springs, Colusa County.
Elsinore Springs, San Diego County.
Hibb's Soda Springs, Shasta County.
Hot Mud Springs, Siskiyou County.
Isham's Springs, San Diego County.
Las Cruces Hot Springs, Santa Barbara County.

Little Yosemite Soda Springs, Tulare County.
Lower Soda Springs, Shasta County.
Madrone Mineral Springs, Santa Clara County.
Magnetic Mineral Springs, Santa Cruz County.
Matilija Hot Springs, Ventura County.
Mill's Mineral Springs, Lake County.
Mission San José Hot Springs, Alameda County.
Monticito Hot Springs, Santa Barbara County.
Nicholas Springs, Santa Cruz County.
Paert's Hot Springs, Mono County.
San Juan Capistrano Springs, San Bernardino County.
San Rafael Springs, Marin County.
Saratoga Mineral Springs, Inyo County.
Shafer's Hot Springs, Lassen County.
Simmons Hot Sulphur Springs, Colusa County.
Stewart's Hot Springs, San Diego County.
Tule River Soda Springs, Tulare County.
Vallejo Sulphur Springs, Solano County.
Veronica Spring, Santa Barbara County.
Warm Sulphur Springs, Kern County.

The following springs not mentioned reported sales of water for 1895:[1]

Alhambra Mineral Spring, Martinez, Contra Costa County.
Almaden Vichy Springs, New Almaden, Santa Clara County.
El Toro Spring, Novato, Marin County.
Mount Lowe Springs, near Pasadena, Los Angeles County.

COLORADO.

Colorado extends from 37° to 41.5° north latitude, and from 102° to 109° west longitude. It is the third largest State in the Union, ranking after Texas and California, and comprises an area of 104,500 square miles. The main range of the Rocky Mountains runs through the centre of the State and forms the Continental Divide. Some of the peaks of this region attain an enormous elevation, and in the giddy heights, yawning chasms, terrific canyons, and perpendicular gulches we find some of the grandest and most awe-inspiring scenery in the world. From one side of the Continental Divide the streams flow into the Gulf of Mexico, and from the other into the Pacific Ocean. The principal rivers are the South Platte and the Arkansas, and these, with their tributaries, suffice to irrigate all the farm-lands in the agricultural portions of the State. The streams are fringed by cottonwood, box-elder, and willow trees, and on the foot-hills and mountains spruce and cedar cover vast areas.

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[1] United States Geological Reports, 1895–96.

Rain falls from May to July, but the other months are dry. The mean annual temperature is about 48° F. The climate of Colorado is proverbially salubrious, the atmosphere being dry and bracing and generally free from malarial and other miasmatic poisons. The annual mortality-rate shown by the latest United States Census returns was 13.23 per 1000, the death-rate from consumption being 1.18 per 1000 of population.

Both hot and cold mineral springs abound in Colorado, and contribute no little to the reputation of the State as a health resort. Some of these, though but recently developed, have already acquired a wide celebrity. The following account of the Colorado mineral water resorts is based upon personal visits and inspection, upon correspondence with different localities of the State, and upon Peale's report to the United States Geological Survey, and Dr. Charles Denison's *Rocky Mountain Health Resorts.*

GLENWOOD SPRINGS,

Garfield County.

Post-office, Glenwood Springs. Hotel Colorado. This magnificent watering place was visited by the author during the autumn of 1893, and the following description is based upon an article published in the *Post-Graduate*[1] for January, 1894, containing memoranda of the visit:

"In a grand amphitheatre of the Rocky Mountains, 5200 feet above the level of the sea, and 280 miles west of Denver, is located the new watering place and health resort which rejoices in the poetic name of Glenwood Springs. This point is reached from the East by the Denver and Rio Grande and the Colorado Midland branch of the Atchison, Topeka and Santa Fé R. R., both transcontinental routes. Dame Nature has been lavish in her adornment of this grand and picturesque region. On emerging from the last of the tunnels of the Grand River Canyon the tourist finds himself in a natural park of perhaps a mile in diameter and several miles in length, surrounded on the north, east, and west by lofty forest-clad hills. The valley is intersected by the Grand River and the Roaring Fork, two romantic mountain streams which unite here to form a current of considerable size. The southern portion of the valley affords a magnificent view of snow-capped Mount Sopris, a peak of surpassing majesty and grandeur. A climb of 2000 feet to the summit of Lookout Mountain, which forms the eastern wall of the amphitheatre, reveals a panorama of dazzling beauty and splendor. Seventy miles eastward is outlined the glistening snow-crowned chain of the Continental Divide, while to the west the eye spans the valley of the Book Cliffs, whose majestic outlines ninety miles distant are clearly defined. To the north stretches the great White River plateau. Turning the eye south the lofty summits of the Elk Range, fifty miles distant across the intervening valleys of the Roaring Fork and Crystal Rivers, come into view. On the left or eastern bank of the Grand River, at the foot of Lookout Mountain, is located the town of Glenwood Springs, a place of about 3000 inhabitants and the county seat of Garfield County. The ground slopes gently from the mountain on the east to the two rivers on the west and south, affording excellent natural drainage. The streets are well laid out at right angles, and the houses for the most part well built and of a substantial character. The town is well lighted by electric illuminators. The climate of the region is superb; the clear, bracing mountain air infusing the visitor at once with a sense of exhilaration and a desire for activity. The humidity of the atmosphere is exceedingly low, as the visitor soon learns by the constant dryness of the lips. The temperature is never excessive in summer, while the nights are invariably cool. During the cold season the location is admirably protected by the surrounding mountains, which form a natural bulwark against the winter winds. Rainy and cloudy weather is the exception, and it is said that invalids may safely be out of doors 320 to 335 days in the year. The prime attraction of Glenwood lies just across the Grand River, where are located the magnificent hot saline-sulphur springs, which give the place its name. These are upward of a dozen in number, but only the two largest—the Yampa and the so-called Cocktail Spring, yielding about 4000 gallons of water per minute—are improved. The waters from these springs are used to supply the recently erected elegant and commodious bath-houses and the mammoth natatorium or swimming pool."

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[1] "Across the Rockies to Glenwood Springs, with an Account of the New Colorado Health Resort," by James K. Crook, M.D.

An analysis of the waters at Glenwood Springs was made by Charles F. Chandler, Ph.D., of New York, June 12, 1888. One United States gallon of 231 inches of water contains the following.

YAMPA SPRING.

Muriated-saline. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	1089.83
Magnesium chloride	13.09
Sodium bromide	0.56
Sodium iodide	Trace.
Calcium fluoride	"
Potassium sulphate	24.04
Calcium sulphate	92.38
Lithium bicarbonate	0.22
Magnesium bicarbonate	13.55
Calcium bicarbonate	24.37

One U. S. gallon contains:

Solids.	Grains.
Iron bicarbonate	Trace.
Sodium phosphate	"
Sodium biborate	"
Aluminum	"
Silica	1.97
Organic matter	Trace.
Total	1260.01

Temperature of water, 124.2° F.

Carbonic acid is copiously discharged from the springs. Sulphureted hydrogen is discharged in perceptible quantity.

"The temperature of the Yampa, the largest spring of the group, as taken by the author, October 21, 1893, was 124.6° F., and of the Cocktail, 126.4° F. The specific gravity of the former when cooled down to 83° F. was 1013, and of the latter a trifle less. That the waters are strongly impregnated with sulphureted hydrogen is readily shown by the heavy deposit of sulphur crystals on stones in the springs and on the surrounding sandstone walls. In the Yampa Spring the gas is in sufficient quantity to impart a decided bluish tinge to the water, rendering it slightly opalescent. The atmosphere immediately surrounding the springs is heavily charged with the escaping vapor. The great swimming pool is upward of an acre in extent, and is graduated in depth from three and a half to five and a half feet. It is constructed of the famous Colorado sandstone, and its bottom is paved with pressed brick.

"The waters from the springs in flowing into the pool are cooled to some extent by contact with the air and by evaporation, but the temperature is further lowered by an artificial cold-water geyser near the western end of the basin, supplied from a near-by mountain reservoir. An average temperature of 93° to 98° F. is thus maintained, and bathing may be indulged in the year round. The cold-water fountain, the spring-board, and the toboggan slide form very agreeable, though not strictly therapeutical, additions to a bath in the pool. In immediate juxtaposition to the natatorium is the sanitarium, or bath-house, recently erected at a cost of $100,000. This establishment has ample facilities for the different varieties of bath, with a lounging and dressing chamber for each bath-room. The pool and bath-house are charmingly located in a little park tastefully adorned with shade trees, flower-bordered walks, and terraced lawns. The eastern boundary of the park is swept by the Grand River, which describes a majestic curve at this point, and separates the grounds from the outside world. On the rising ground coterminous with the western boundaries of the park, and forming a charming centre-piece against the dark timber-clad mountain background, is located the new Hotel Colorado, opened in June, 1893. The Eastern visitor is struck with amazement at the evidences of modern comfort, convenience, and luxury which greet the eye at every turn in this beautiful and commodious caravansary. Space prevents us from going into details; but when we have said that the guest will find in the Colorado every arrangement for his well-being and comfort that the newest and best hotels of New York can supply, further description is unnecessary.

"Another interesting and unique feature of Glenwood Springs should not pass unnoticed. Across the river from the Yampa, and two or three hundred yards up the stream, is the entrance to a cave which extends for some distance under the mountain. This cave has a natural temperature ranging from 105° to 110° F., which is saturated at all times with the vapor of water strongly impregnated with sulphur like that of the springs. After a few minutes in the cave the surface of the body is bedewed with a profuse perspiration. Advantage has been taken of this natural vapor chamber, and a bath-house, with the requisite adjuncts, has been constructed at its entrance. The cave itself is lighted by electricity, and attendants are on hand to supply the wants of bathers, either in the cavern or in private rooms.

"The adaptability of Glenwood Springs as a health resort may be considered with reference to two important points:

"1. As to the climate and general surroundings. The high elevation, the protected situation, and the pure, dry, atmosphere place it at once on a par with such well-known resorts as Manitou and Colorado Springs. From *a priori* reasoning, we would deem the location suitable for debilitated conditions resulting from almost any cause, but especially those due to pulmonary trouble. Almost all persons in such conditions visiting the place experience a gain in weight and strength appreciable within a few days after arrival. The rarefied air would, of course, be a contraindication in cases of heart disease, aneurism, or the hemorrhagic diathesis.

"2. As to the springs and baths. The waters are highly thermal, and the analysis and other evidences show them to be strongly saline and sulphureted. What we require now is the careful medical observation of actual, individual cases. During the author's sojourn at the springs a number of persons, some of them from distant points, were using the baths, but they were for the most part acting under their own guidance, which fact invalidated their testimony. As far as could be learned, however, the evidence is strongly in favor of the utility of the baths in cases of chronic rheumatism, gout, cutaneous and renal diseases. One old gentleman, who had suffered for an indefinite period from rheumatism in his hip, assured the author that he gained more benefit from two of the baths at full heat than he had received from years of previous treatment. A gentleman from Illinois, suffering from chronic nephritis, who had been treated by a number of well-known physicians, including Dr. Belfield, of Chicago, had resorted to the vapor cave in an almost helpless condition three months previously. His improvement, as shown by a loss of his headache, an increased daily quantity of urine, and a gain in weight and strength, had begun at once and had been steadily maintained. In common with all hot baths, these waters are contraindicated in fatty degeneration of any important structure, in atheroma, aneurism, or organic heart disease, and in the predisposition to pulmonary, cerebral, gastric, or intestinal hemorrhage. In conclusion, it may be said that for cases requiring a high, dry, and bracing atmosphere, for those in which hot saline-sulphur baths are indicated, or for persons who simply seek recreation or pleasure, Glenwood Springs offers superior advantages."

HOT SULPHUR SPRINGS,

MIDDLE PARK, GRAND COUNTY.

Hotels. Access *via* Union Pacific R. R., fifty miles west from Denver to Georgetown; thence by daily stage fifty miles to springs, passing over the Snowy, or main range, of the Rocky Mountains at 11,250 feet altitude.

These springs are located in the Middle Park on the banks of the Grand River, 7625 feet above the sea-level. This river forms the only drainage outlet to the Middle Park, a mountain basin ninety by fifty miles in extent. The enclosing peaks vary in height from 9000 to 14,000 feet. The prevailing weather in this neighborhood is clear, with westerly winds. There is considerable snow in winter, with a steady range of temperature of about 32° to 50° F., but occasionally dropping as low as 20° to 25° below zero. As many as twenty-two of the springs are well situated for improvement, although the baths now in use take water from only three or four. The exact flow of water cannot be stated positively, although it is believed to be greater than that of the Arkansas Hot Springs. A strong smell of sulphureted hydrogen pervades the neighborhood of the springs, and with a favoring wind may be noticed for a distance of hundreds of rods up the valley. The channels through which the waters flow are lined with a soft, yellowish-white, velvety substance, having the odor of sulphur.[1] This substance is evidently not a sediment, as it stands up like the pile of velvet, and is not deposited in layers, while the water itself is as clear and bright as that of any mountain spring. It is said to be very palatable and to rest well on delicate stomachs. The following analyses were made some years ago by Prof. Mallett, Jr.:

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[1] Probably a confervoid growth known as sulfuraria.—J. K. C.

HOT SULPHUR SPRINGS.

Saline-sulphureted.

Spring No. 1 (Red Sulphur). Temperature, 109.5° F.

One U. S. gallon contains:	Grains.
Calcium carbonate	10.08
Sodium carbonate	58.57
Magnesium carbonate	6.57
Sodium chloride	14.61
Sodium sulphate	8.48
Potassium sulphate	0.50
Free carbonic acid	2.94
Lithium	Trace.
Iron	“
Total	101.75

Spring No. 2 (Saline). Temperature, 91° F.

One U. S. gallon contains:	Grains.
Sodium carbonate	50.45
Sodium sulphate	8.97
Sodium silicate	1.46
Potassium sulphate	0.07
Magnesium carbonate	4.14
Iron	Trace.
Lithia	“
Ammonia	“
Total	65.09

Spring No. 3 (Alum). Temperature, 97.5° F.

One U. S. gallon contains:	Grains.
Sodium carbonate	20.37
Sodium sulphate	17.53
Sodium chloride	13.29
Potassium sulphate	1.03
Magnesium sulphate	5.26
Silicic acid	0.61
Free carbonic acid	8.42
Iron	Trace.
Lithia	“
Ammonia	“
Total	66.51

Spring No. 4 (Little Sulphur). Temperature, 111° F.

One U. S. gallon contains:	Grains.
Sodium carbonate	29.42
Sodium sulphate	14.25
Sodium chloride	12.18
Potassium sulphate	7.03
Magnesium carbonate	2.66
Calcium carbonate	8.46
Silicic acid	0.54
Free carbonic acid	0.42

One U. S. gallon contains:	Grains.
Iron	Trace.
Ammonia	"
Total	74.96

Spring No. 5 (Big Sulphur). Temperature, 115° F.

One U. S. gallon contains:	Grains.
Sodium carbonate	39 37
Sodium sulphate	9.85
Sodium chloride	13.97
Potassium sulphate	0.96
Magnesium carbonate	1.93
Calcium carbonate	3.68
Free carbonic acid	9.49
Silicic acid	1.31
Iron	Trace.
Ammonia	"
Total	80.56

Spring No. 6 (Bath Spring). Temperature, 117° F.

One U. S. gallon contains:	Grains.
Sodium carbonate	22.42
Sodium sulphate	25 11
Sodium chloride	13.11
Potassium sulphate	1.69
Calcium carbonate	6.43
Free carbonic acid	4.69
Silicic acid	1.36
Iron	Trace.
Ammonia	"
Total	74.81

The supply of water furnished for analysis was insufficient to detect solids present in exceedingly minute quantities. The lithia was discovered by means of a spectroscope in the residue left after evaporating 300 cubic centimetres of the water.

No gaseous constituents are shown, as the analyses were made from bottled water, which had been standing for some time after removal from the springs, and it is believed that the sulphureted hydrogen (or other gas) which may have been present had either escaped or been oxidized to sulphuric acid. The waters are recommended in cutaneous, hepatic, uterine, neuralgic, gouty, and rheumatic disorders, and in the manifestations of tertiary syphilis. As with thermal waters generally, they are contraindicated in most acute diseases, in tuberculosis and cancer, in fatty degeneration of any important structure, in aneurism or organic heart-disease, and in predispositions to cerebral, gastric, pulmonary, or intestinal hemorrhage. There are two hotels at the Hot Sulphur Springs and several private houses where guests may obtain accommodations.

IDAHO HOT SPRINGS,

Clear Creek County.

Post-office, Idaho Hot Springs. Hotel. Access *via* Colorado Division of the Union Pacific R. R., the route lying through the famous Clear Creek Canyon.

These springs are situated in the Rocky Mountains at an elevation of 7500 feet above the sea-level. The location is exceedingly picturesque, and the climate of a wholesome and salubrious character. Invigorating mountain breezes prevail throughout the summer. The facilities for bathing form a special attraction at these springs. Three immense swimming pools have been constructed, besides numerous private baths, the water ranging in temperature from 85° to 115° F. A natural tunnel furnishes excellent conveniences for a ready-made vapor bath, and is largely resorted to. The following analysis of the Idaho Hot Springs water has been made by J. G. Pohle, analytical chemist:

IDAHO HOT SPRINGS.

Alkaline-saline.

One U. S. gallon contains:	Grains.
Sodium carbonate	30.80
Calcium carbonate	9.52
Magnesium carbonate	2.88
Iron carbonate	4.12
Sodium sulphate	29.36
Calcium sulphate	3.44
Sodium chloride	4.16
Calcium and magnesium chlorides	Trace.
Sodium silicate	4.00
Magnesium sulphate	18.72
Total solids	107.00

Within five minutes' walk of the Hot Springs there is a cold spring of sparkling, effervescent water, excellent for drinking purposes. A good carriage road leads to the summit of Bellevue Mountain, less than three miles distant, which is said to afford the most majestic mountain view in Colorado.

MANITOU SPRINGS,[1]

El Paso County.

Post-office, Manitou Springs. Hotels: Barker, Cliff House, Manitou House, Mansions, and numerous others. Access *via* Denver and Rio Grande and Colorado Midland R. R.

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[1] So called by the Indians ("Manitou"—the Great Spirit), to whom the springs were known for many generations.

Manitou is situated six miles west of Colorado Springs, immediately at the foot of Pike's Peak. Here are located the celebrated effervescent soda and iron springs which in early days gave the name of springs to the town of Colorado Springs. An electric railroad, with cars at frequent intervals, unites the two places. The town of Manitou Springs contains a permanent population of more than 2000 souls, which number is augmented during the summer months by about 125,000 visitors from all parts of the United States and from foreign countries. Dame Nature was in a fanciful mood when she fashioned the topography of this wild and rugged region. Few similar areas of the earth's surface present a greater number and variety of weird, grotesque, and romantic features than are to be found in the vicinity of Manitou Springs. The scope of this work allows us only to enumerate a few of the more prominent points of interest within a few miles of the place. Iron Springs and Hotel, one mile; Rainbow Falls and Grand Caverns, one and one-quarter miles; Crystal Park, three miles; Garden of the Gods, three miles; Glen Eyrie, five miles; Monument Park, by rail, seven and one-half miles; North Cheyenne Canyon, eight and one-half miles; South Cheyenne Canyon, nine miles; Summit of Pike's Peak (*via* cog-wheel railroad), twelve miles. In addition to these well-known localities there are scores of canyons, caves, waterfalls, and charming nooks which the sojourner may seek out for himself. The railroad journey to the top of Pike's Peak is one never to be forgotten. The view from the immense height of 14,147 feet is almost appalling in its scope and grandeur. A post-office for the benefit of tourists is maintained at the apex of the Peak by the National Government during the summer season. It has been well described as the loftiest post-office in the United States.

The meteorological conditions at Manitou and Colorado Springs are very favorable to invalids, the climate being dry and the temperature even and not subject to sudden changes. The winter months are mild and pleasant—so mild, indeed, that excursions are almost daily made to the neighboring canyons and glens, where outdoor picnics are held with as much safety to health as in the summer.[1] Within the town limits are nine cold springs, which are divided into two groups: (1) the Soda Springs, which resemble in taste and properties the well-known Apollinaris water; and (2) the Iron Springs. These springs are controlled by the Manitou Mineral Water Company, and, in addition to the immense local consumption by visitors, are bottled and sold to dealers throughout the United States. The Manitou Ginger-ale and Manitou Soda-water also have an extensive sale, and an inspection of the immense bottling establishment of the company is one of the features of a visit to the resort.

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[1] Dr. L. D. Seebree gives us the following average temperatures for the winter months: November, 48°; December, 43°; January, 40°; February, 48°; March, 50°; April, 64°. These records were made at 12 noon. At 6 P.M. the temperature was 12° to 15° lower. There was no rain from November 11th to March 15th.

The two principal springs, as analyzed by Prof. Elwyn Waller, Ph.D., analytical chemist, New York City, were found to contain:

MANITOU SODA SPRINGS.

One U. S. gallon contains: Solids.	Manitou. Grains.	Navajo. Grains.
Sodium chloride	23.94	23.79
Potassium sulphate	10.68	15.35
Sodium sulphate	11.14	10.93
Sodium carbonate	40.66	42.60
Lithium carbonate	0.71	0.61
Calcium carbonate	69.08	69.33
Magnesium carbonate	16.68	16.04
Iron oxide	0.02	0.02
Alumina	0.07	0.10
Silica	2.49	2.46
Total	174.47	182.23

Both containing free carbonic acid gas.

The waters of these springs are especially recommended in dyspepsia. During the author's sojourn at the springs, he had abundant opportunity to test the virtues of the Soda Springs in his own person and in that of one of his travelling companions. A glass of this water will almost instantly give relief in pyrosis, acid eructations, or flatulence, and its habitual use prevents the recurrence of these disagreeable symptoms. They are further of decided benefit in renal and bladder disorders. The waters of the Soda Springs, being clear, sparkling, and exceedingly palatable, form an excellent table beverage. The iron waters are highly beneficial in debility, in early phthisis, and in anæmia and chlorosis.

Numerous excellent hotels and boarding houses are maintained at Manitou Springs. The visitor will find all the arrangements for his comfort and well being to be had at any first-class Eastern resort.

MORRISON SPRINGS,

JEFFERSON COUNTY.

Post-office, Morrison. Hotel recently built. Access from Denver *via* Denver, Gunnison and Leadville Railroad.

Morrison Springs are located fourteen miles southwest from Denver, in the basin of Bear Creek, and just within the Rocky Mountain foot-hills, at an altitude of 6000 feet above the sea-level. No complete quantitative analysis of the waters seems to have been made, but Dr. W. C. McNeal, of Morrison, furnishes us the following report of a partial qualitative examination:

Sulphureted hydrogen.
Calcium bicarbonate.
Manganese.
Iron.
Magnesium sulphate (40 grs. per gal.).
Potassium (trace).
Sulphuric acid } Doubtless in combination.
Arsenious acid }

Temperature of water, 80° F.

This incomplete analysis would indicate that the waters possess tonic, laxative, and alterative properties. They are recommended in renal, digestive, skin, and rheumatic affections, and in chronic syphilis.

OURAY SPRINGS,

OURAY COUNTY.

Post-office, Ouray. Hotel and cottages. Access *via* Denver and Rio Grande R. R. (narrow-gauge) from Denver, Colorado Springs, and Pueblo.

The town of Ouray is situated in a picturesque amphitheatre of the Rocky Mountains, 389 miles from the city of Denver. The altitude of the town-site is 7500 feet above the sea-level, but the neighboring mountain peaks tower several thousand feet higher. Mt. Snefflis, five miles west, reaches an elevation of 14,225 feet, while Uncompahgre Peak, ten miles east of the town, attains the superb altitude of 14,440 feet above tide-water. The famous and beautiful Bear Creek Falls are two miles south of the town, and near them is the wonderful piece of toll-road, cut in walls of perpendicular quartzite. All about the neighborhood are rich mines of gold and silver. There are also many other natural features of interest, including caves, water-falls, canyons, peaks, lakes, and gorges, reached by good roads or mountain trails. The climatic conditions about Ouray are quite unexceptionable, sunshine being the rule, with warm and pleasant days during the summer, followed by cool, refreshing nights. The highest summer temperature is about 90° F., and the lowest winter minimum 5° F.; but, owing to the rarity and dryness of the atmosphere, these extremes represent much less variation than in most localities of the East. The number of springs in the town limits is estimated at more than 100, the temperature of their waters ranging from 130° to 140° F. No analysis has been made, but we are informed by the proprietor of a number of the springs that the waters contain lime, soda, manganese, and iron, and some of them sulphur. Two bath-houses have been fitted up, and are much resorted to in the treatment of rheumatic affections. It is said that the internal use of the waters has been found beneficial in cases of dyspepsia, indigestion, constipation, and blood and skin disorders.

The city of Ouray has about 2500 permanent inhabitants, and is well supplied with pure and wholesome water from mountain springs by water-works constructed on the gravity plan. The city possesses a complete system of sewerage, and is always in a clean and healthful condition. The climate is said to be very beneficial to persons suffering from bronchial and pulmonary troubles.

PAGOSA SPRINGS,

ARCHULETA COUNTY.

Post-office, Pagosa Springs. Hotels and boarding-houses. Access *via* Denver and Rio Grande R. R. to Amargo, New Mexico, thence twenty-eight miles by daily stage over a good road to the springs.

This resort is located in a picturesque, heavily wooded mountain region, at an altitude of about 7000 feet above the sea-level. Bear, elk, deer, and wild turkeys abound in the neighboring mountains, and it is said that a basket of trout may be taken at any time without going beyond the village limits. The country is new, but is fast being developed, and hundreds of people from different parts of the United States camp out in the neighborhood every summer, in order to avail themselves of the salubrious climate and many other attractions to be found here. There is considerable snow in January, February, and March, but during the remainder of the year the weather is clear and beautiful. The summer temperature reaches 90° F. at times, but owing to the bracing atmosphere no discomfort is felt. The nights are always cool.

There is but one mineral spring at Pagosa. It is situated on a small elevation, and from it the water issues through crevices in various directions. The water-supply is quite inexhaustible, as it is estimated that the combined currents from the spring would form a stream three feet deep and six feet wide.

Dr. H. G. Haxby, of the springs, furnishes us the following analysis, supposed to have been made under the auspices of the United States Government when it maintained a fort at this point :

PAGOSA HOT SPRINGS.

Alkaline-saline.

One U. S. gallon[1] contains:	Grains.
Sodium chloride	61.81
Sodium carbonate	83.27
Sodium sulphate	150.21
Calcium carbonate	41.76
Magnesium carbonate	6.65
Lithium carbonate	3.28
Potassium carbonate	2.80
Iron protoxide	0.16
Manganese protoxide	0.11
Calcium fluoride	0.30
Calcium phosphide	0.03
Silica	0.71
Total	351.09

Temperature of water, 155° F.
Elevation, 7000 feet.

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[1] Converted from grammes per litre.

The waters are said to possess valuable properties in the treatment of rheumatism, gout, syphilis, and anæmic conditions. Dr. Haxby informs us that he has seen exceedingly obstinate cases of chronic rheumatism cured or greatly benefited by a two weeks' course of the hot baths.

PONCHO HOT SPRINGS,

CHAFFEE COUNTY.

Post-office, Poncho Springs. Hotel and cottages. The springs are reached by the Denver and Rio Grande R. R. (three trains daily); stages from the hotel meet all trains. The springs are said to be more than 100 in number and to flow 1,000,000 gallons of water hourly. The topography of the country is broken and rugged, the hotel being situated on the mountain side at an elevation of 8000 feet above tide-water. The summer temperature ranges from 60° to 85° F.; winter, 40° to 25° F., the mercury very seldom dropping to zero. Mr. L. L. Woodruff, the manager of the springs, furnishes the following rather indefinite analysis by an unknown chemist. The figures probably refer to grains per gallon:

Analysis.

Silicic acid	32.73
Sesquioxide of iron	1.27
Alumina	5.20
Lime	20.00
Magnesia	0.74
Chlorine	0.06
Carbonic acid gas	22.50
Organic matter	6.24
Water	1.72
Sulphuric acid	4.46
Potash	2.08
Soda	1.00
Iodine	1.50
Bromine	1.50
Total	101.00

Temperature of water, 145° to 185° F.

The springs furnish ample facilities for plunge, vapor, and tub baths. Rheumatism, blood and skin diseases are among the disorders benefited by the baths and waters at Poncho.

ROYAL GORGE HOT SPRINGS,

FREMONT COUNTY.

Post-office, Canyon City. Hotel. Access from Denver *via* Denver and Rio Grande R. R. Canyon City is also the western terminus of the Arkansas Valley Branch of the Atchison, Topeka, and Santa Fé R. R. The town of Canyon City, with a population of 3500, is rapidly becoming a charming city of healthful, cosey homes. It is the county seat of Fremont County, and is situated on the north and south banks of the Arkansas River, one hundred and sixty miles south by west of Denver and one hundred miles below Leadville. The scenery about the place is grand and romantic to a high degree. A few minutes' walk takes the tourist to the famous Royal Gorge, where the granite cliffs tower 2000 feet above the head. Within half an hour's ride on horseback is the top of the great Fremont Peak, offering a panorama to the enraptured eye as sublime as the imagination could depict. The altitude of the springs is 5200 feet above the sea-level. The location is protected by the mountains on three sides, and the report of the United States Meteorological Bureau shows that for any given month in winter the temperature on an average is six degrees warmer than at any other point in the State. The rainfall is only 14 inches per annum, and it is said that there are over 300 sunny days in every year. The capacity of the hot springs is difficult to estimate, as they break out into the Arkansas River in several places. One of them, which issues from the earth a little above low water, yields 15 gallons per minute, but the combined flow of the springs would be many times greater.

Within half a mile of the hot springs are cold soda and iron springs. Excellent bathing facilities have recently been provided at the hot springs.

The following analyses are by Prof. Oscar Loew, of the United States Geological Survey:

ROYAL GORGE HOT SPRINGS.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	73.20
Magnesium carbonate	12.80
Calcium carbonate	33.50
Sodium sulphate	79.30
Sodium chloride	18.20
Lithium chloride	Trace.
Total	217.00

Temperature of water, 102° F.

ROYAL GORGE COLD SODA AND IRON SPRINGS.

One U. S. gallon contains:

Solids.	Iron Duke. Grains.	Little Ute. Grains.
Sodium chloride	83.00	118.00
Sodium sulphate	12 20	12.10
Sodium carbonate	76.80	76.40
Calcium carbonate	33.00	22.50
Magnesium carbonate	14.60	14.00
Iron	Traces.	Traces.
Lithia	"	"
Total	219.60	243.00

The waters of both cold and hot springs are highly charged with carbonic acid gas. The hot baths here are highly recommended for rheumatism and skin diseases. Dr. Prentiss, of Canyon City, informs us that persons suffering from pulmonary trouble are usually much improved by a sojourn in the sunny, even climate of this region.

SPRINGDALE SELTZER SPRINGS,[1]

BOULDER COUNTY.

Post-office, Springdale. Hotel. These springs are located in James Creek Canyon, ten miles from Boulder and eighteen miles from Longmont. Within easy distance are Balarat, Gold Hill, Sunshine, and Jamestown, these being the largest mining camps of Boulder County. The famous "Golden Age," "Big Blossom," and "Rip Van Dam" mines are also close at hand. There are a number of springs in the neighborhood, varying in their ingredients and therapeutical effects, but the only one used commercially is the Seltzer Spring water, of which the following is an analysis by Dr. Jackson, State Assayer of Massachusetts:

SPRINGDALE SELTZER SPRINGS.

Saline-chalybeate. Iodated and bromated.

One U. S. gallon contains:	Grains.
Sodium sulphate	107.55
Calcium carbonate (bicarbonate in the water)	43.31
Sodium chloride	4.95
Sodium iodide and bromide	1.28
Sodium bicarbonate	5.46
Iron bicarbonate	3.99
Magnesium bicarbonate	0.74
Sodium silicate in the water	3.99
Total	171.27

As shown by the analysis, a close analogy exists between these waters and those of the Saratoga Seltzer and the Old Source Spring of St. Moritz, Switzerland. They are weaker than the Saratoga Seltzer in lime and chloride of sodium, but stronger in iron and sulphate of sodium. The Springdale water contains six times as much of the latter salt as the Old Source water.

According to Dr. Charles Denison, of Denver, the Springdale water possesses valuable alterative and tonic properties, and is also slightly diuretic. It is indicated in dyspepsia, debility, anæmia, etc.

STEAMBOAT SPRINGS,

ROUTT COUNTY.

Post-office, Steamboat Springs. Hotels. Access *via* Denver and Rio Grande R. R. to Walcott, thence by stage, a twelve hours' ride to springs. Also connected by good mountain roads with Laramie City, Wyoming, and with Georgetown, Dillon, Glenwood Springs, Hayden, and other points.

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[1] Described by Walton under the name of "Rocky Mountain Springs."

The town of Steamboat Springs is located in a charming valley in northwest Colorado, just over the main range of the Rocky Mountains, and near the headwaters of the Yampa River. The site is upon a bend of the Yampa, where, from its northerly flow, it turns sharply to the west. The mountain range here follows the contour of the river, lifting its lofty summits, covered all summer with their ever-melting but never-melted snow on two sides of the valley, to the north and east. Thus is formed a natural basin, sheltered on the side toward the north by its mountain bulwark, leaving its southern slope open to the rays of genial sunshine. Three large mountain streams—Soda Creek, Crystal Brook, and Spring Creek—rise at different points along the curve in the mountain range, and, converging as they flow down, join the Yampa on the town site. These bring a never-failing supply of pure water from the summits of the mountain, and with a group of sixty varieties of hot, warm, and cold mineral springs make this valley one of the most remarkable natural watering places in the world. The first settlement was made in the valley in July, 1874, by Mr. James H. Cranford, the present manager of the springs. Since that time a flourishing town, containing churches, schools, libraries, banks, newspapers, and other adjuncts of civilization, has sprung into existence. The town and vicinity offer many attractions to the enterprising settler, as well as to the tourist, the sportsman, and the invalid. The climate during the open season—*i. e.*, from April until late in December—is ideally temperate, clear, balmy days and cool nights being the rule. The springs, one hundred and forty in number, yield an exhaustless supply of water, but they have not been fully developed as yet. They range in temperature from 40° to 103° F., but none of them appears to have been subjected to a complete analytical examination. Among the prominent ingredients are soda, magnesia, iron, and sulphur. The waters have been found useful in rheumatism and skin diseases, and were resorted to by the Indians for many years before the appearance of the pale-face in this region. A large bath-house with swimming-pool and numerous bath-rooms has been built to utilize the water from the hot springs.

Wagon Wheel Gap Hot Springs, Rio Grande County, on the Wagon Wheel Gap branch of the Denver and Rio Grande R. R., are now used as a resort. The springs are three in number. Nos. 1 and 3 are hot; temperature 150° F. and 140° F., respectively, and contain, according to Lieutenant Wheeler, U. S. A., salts of sodium, calcium, magnesium, lithium, and potassium, and sulphureted hydrogen. No. 2 is cold and feebly mineralized. A very good hotel has been built. All varieties of baths, and two swimming reservoirs have also been constructed.

The following springs and wells of Colorado are used as resorts :

Artesian Magnetic Mineral Spring, Pueblo, Pueblo County.
Hartsel Hot Mineral Springs, Hartsel, Park County.
Liberty Hot Springs, Wagon Wheel Gap, Rio Grande County.
Parnassus Springs, Red Creek, Pueblo County.
Porter's Springs, Denver, Arapahoe County.
Shaw's Magnetic Springs near Del Norte, Rio Grande County.
Tomichi Hot Springs, Elgin, Gunnison County.
Trimble Springs, Trimble, La Plata County.
The following springs are used commercially:
Canyon City Vichy Springs, Canyon City, Fremont County.
Carlile Soda and Iron Springs, near Pueblo, Pueblo County.
Colorado Carlsbad Springs, Barr, Arapahoe County.
Hiawatha Spring, Manitou, El Paso County.

As Colorado is but thinly settled, it possesses numerous springs which have not yet been improved.

CONNECTICUT.

Connecticut, one of the original thirteen States, extends from 41° to 42° 2¾′ north latitude, and from 70° 55′ to 73° 50′ west longitude, It comprises an area of 4730 square miles. The principal rivers are the Connecticut, Thames, Housatonic, Naugatuck, and Mystic. Numerous miniature lakes are distributed over its surface. The climate of Connecticut is marked by great extremes and sudden changes; the winters are cold, the summers very warm. The district bordering on the sea is the hottest, and the northwestern portion the coldest. The mean annual temperature as observed at Hartford is about 50° F., and the rainfall varies from 41 to 47 inches, according to the place of observation. The State has no lofty mountains, but its limits include the southern extremities of the two great New England ranges—the Green and the White Mountains. The mortality-rate, according to the last census, was 19.52 per 1000. The death-rate from phthisis was 2.34 per 1000.

The mineral springs of Connecticut are comparatively unimportant, at least in point of number, and are not densely mineralized. They are chiefly feeble chalybeates, occurring in deposits of bog-iron ore or in connection with iron pyrites. Some are also weakly sulphureted. Many of the Connecticut springs have never been improved, and few of the waters have been used in commerce, yet some of them have had considerable local celebrity. The reputation of Stafford Springs, the only locality given by Walton, long since transcended the limits of the State. Some of the places once resorted to have fallen into disuse. The following account of the springs in present use was gained chiefly by correspondence with various persons in the State. Little can be learned from the recognized publications on the subject of springs.

NORTH HAVEN POOL,

NEW HAVEN COUNTY.

The waters of this pool have had a local reputation for more than one hundred years, and it is said that Dr. Trumbull, the historian of Connecticut, was in the habit of accommodating boarders who came to avail themselves of their medicinal effects. According to an analysis by Prof. S. W. Johnson, the following ingredients are found :

Sodium sulphate.
Sodium chloride.
Potassium sulphate.
Calcium sulphate.
Calcium carbonate.
Magnesium carbonate.
Ferrous carbonate.
Silicic oxide.
Alumina . .
Ammonia . . } Traces.
Phosphoric acid

The iron is present in sufficient quantities to give the waters useful tonic properties. They are said to be of decided value in chronic skin affections. The waters are bottled and sold in one-, two-, and four-gallon jugs.

OXFORD MINERAL SPRING,

NEW HAVEN COUNTY.

Post-office, Oxford. Good hotel within one-half mile.

This spring has been well known to residents of the neighborhood for many years, but it has only recently been brought to the attention of the public. Its medicinal properties are supposed to have been known to the Indians, as arrowheads and other evidences of aboriginal life are frequently found near it. The spring yields about 1½ gallons of pure, sparkling water per minute. An analysis by Prof. George F. Barker, of the Sheffield Scientific School, in 1873, resulted as follows :

OXFORD MINERAL SPRING.

Light Saline-chalybeate.

One U. S. gallon contains :

Solids.	Grains.
Sodium chloride	0.35
Sodium sulphate	0.49
Potassium sulphate	Trace.
Lithium sulphate	"
Magnesium sulphate	0.62
Calcium sulphate	1.16
Iron carbonate	0.91
Silica and insoluble matter	1.33
Organic matter	1.22
Loss in analysis	0.10
Total	6.18

The path of the stream can be easily traced by the abundant bright yellow deposit of hydrate of iron. In the short time since this water was brought before the public it has risen high in popular favor as an invigorant and general tonic. It is useful in conditions of debility and anæmia, and in stomach, liver, and renal disorders, etc. The water is used commercially, and is said to be acquiring an extensive sale.

SOUTH FARM MANGANO-CHALYBEATE WELL,

Litchfield County.

Post-office, Litchfield. Inn and cottages. Access *via* New York, New Haven, and Hartford R. R. to Litchfield, thence two miles by carriage to spring.

This pleasant new resort is located in a hilly section of Connecticut, 1114 feet above sea-level, and is surrounded by lovely scenery. The climatic conditions during the season, lasting from May to December, are very desirable. The following table shows the temperature-range for July and August, 1896:

	8 A.M.	Noon.	3 P.M.
July	71.5	76	77.5
August	68.5	74	75

The flow of water from the well is 960 gallons per hour. An analysis by Messrs. E. E. Smith, Ph.D., and Rudolf De Roode, Ph.D., of Fraser & Co., New York, made in 1897, resulted as follows:

SOUTH FARM MANGANO-CHALYBEATE WELL.

Light Alkaline-chalybeate. Manganic.

One U. S. gallon contains:

Solids.	Grains.
Lithium chloride	Trace.
Potassium chloride	"
Sodium chloride	0.78
Calcium sulphate	1.01
Calcium bicarbonate	1.98
Magnesium bicarbonate	2.61
Iron bicarbonate	0.77
Manganese bicarbonate	0.08
Alumina	Trace.
Silica	0.59
Total	7.82

Reaction of water slightly alkaline.
Temperature of water, 45° F.

This water is not heavily mineralized, yet it is as rich in chemical ingredients as many others, for which valuable therapeutic properties are claimed. There is sufficient iron to produce tonic and restorative effects after continuous use, and the saline and alkaline ingredients impart a mild antacid and diuretic action. It cannot at present be stated positively whether or not the small amount of manganese modifies in any way the action of the water. It is probable that in large and continuous doses the physiological and therapeutical effects of the substance would eventually be produced.

The South Farms Inn is a comfortable and well-kept establishment, and is already finding favor with well-to-do New Yorkers. The place offers many attractions as a resort for the summer months.

STAFFORD SPRING,

Tolland County.

Post-office, Stafford Springs. Accommodation in private families. Access *via* New London and Northern R. R. from junctions at Willimantic, Conn., and Palmer, Mass.

This historical old spring has been known as a resort since the year 1750, and its waters were celebrated among the aborigines for many years prior to that date. During the latter part of the last and for many years of the present century the place was held in high favor throughout New England and the neighboring States. The records of the guests of former days are filled with the names of people distinguished in all the walks of life. Among these names we find those of Dr., afterward General, Joseph Warren, and President John Adams The development of other springs has detracted from the prestige of Stafford, but under an enterprising management the resort will no doubt again acquire a prominent place in public favor. Heretofore the water could be obtained only at the spring, but it is now bottled and shipped to any desired point.

The country about Stafford Springs is diversified by hills and valleys, and the landscapes are very pleasing during the summer months. The flow of water from the spring amounts to about 55 gallons per hour. We are indebted to Dr. J. M. Sheehan for the following analysis by Lewis Norton, Ph.D., of the Massachusetts Institute of Technology:

STAFFORD SPRING.

Light Saline-chalybeate. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.31
Potassium sulphate	0.21
Sodium sulphate	0.96
Sodium bicarbonate	0.46
Sodium phosphate	0.22
Iron peroxide	0.67
Iron protoxide	Trace.
Alumina	0.11

One U. S. gallon contains:

Solids,	Grains.
Lime	0.41
Silicic acid	2.00
Magnesia	0.03
Moisture and volatile matter	1.72
Total	7.10

Carbonic acid gas, 25 cubic inches.

The water is clear and sparkling and excellent for table purposes. It has attained its greatest reputation in the treatment of blood and skin affections. It is said to be actively diuretic.

STARK MINERAL SPRING,

NEW LONDON COUNTY.

Post-office, Bozrah. Visitors accommodated in private families. Location: Three miles from Yantic, on the Central Vermont R. R.

The waters of this spring issue from a rocky hillside on the farm of Mr. Everett N. Stark, at an altitude of about 1000 feet above the sea-level. Its history has been known to a few old families in the neighborhood since the first settlement of the country, and dates back to a time when all accurate record is lost in the obscurity of tradition. There seems to be no doubt, however, that its waters were used for medicinal purposes by the Indians long before the region was known to the European settlers. The surroundings of the spring are very charming during the summer months, and an increasing number of visitors are attracted to the spot every year. The flow of water is about 3 gallons per minute, and its temperature about 40° F. The following analysis was made by Prof. S. W. Johnson, of Yale University, in 1880:

STARK MINERAL SPRINGS.

Neutral.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.33
Sodium sulphate	0.18
Sodium bicarbonate	0.30
Potassium bicarbonate	0.10
Calcium bicarbonate	1.23
Magnesium bicarbonate	0.33
Iron bicarbonate	0.06
Silicic acid	0.85
Total	3.38

The analysis shows the spring to be but feebly mineralized. The waters, however, have been considered useful in some of the functional disorders of the liver, kidneys, and bladder. It is a good table water.

The following spring is reported as a resort by the United States Geological Reports:

Kenyon's Mill Spring, Colchester, New London County.

The following are used commercially:

Althea Spring, Waterbury, New Haven County.

Arethusa Spring, Seymour, New Haven County.

Some of the springs of the State formerly in use have been abandoned.

DELAWARE.

Next to Rhode Island, Delaware is the smallest State in the Union, its territory comprising an area of only 2120 square miles. The borders of the State extend from 38° 28′ to 39° 50′ north latitude. The Delaware River, which washes the eastern border, is the only navigable stream in the State, the other rivers being the Indian and Nanticoke. The climate is quite mild, the mean annual temperature being about 53° F. In the northern portion it is much colder and more healthful than in the southern. The surface in the north is diversified by hill and dale, but in the southern portion it is almost a dead level. The mortality-rate in 1890 was 18.53 per thousand of population. From the few reports of geological surveys of Delaware we are informed that chalybeate springs are numerous, as would naturally be expected from the geological structure. They seem, however, to be comparatively unimportant. A search through all the available literature pertaining to mineral springs, supplemented by considerable correspondence, has failed to develop information of a single locality used at this time as a resort. The Brandywine Chalybeate Spring, in New Castle County, which was at one time used as a resort, has long since been abandoned, Peale's list comprises springs in Sussex, Dover, and Kent Counties, but they have never been improved.

The State reports no sales of mineral water in the latest bulletins of the United States Geological Survey.

DISTRICT OF COLUMBIA.

The District of Columbia comprises an area of sixty-four square miles, and is bounded on the south by the Potomac River, the remainder being enclosed by the State of Maryland. The surface is undulating and surrounded by hills of 150 to 400 feet elevation. The climate is moist and warm, the mean annual temperature being 56.16° F. and the average rainfall 37.62 inches. There is considerable malaria in the lower sections. The East Potomac River and Rock Creek traverse the District and disembogue into the Potomac. Anacostia River is a broad and shallow tidal stream. The death-rate in 1890 was 25.85, and the phthisical mortality-rate 3.59 per 1000 of population. A number of wells and springs within the limits of the District are chalybeate, but none of them, even the strongest, is of much importance. At Uniontown, or Anacostia, opposite Washington, and also near Le Droit Park, in the northeastern part, chalybeate springs exist. A well in Washington, on Louisiana Avenue, between Ninth and Tenth Streets, is said to be quite strongly impregnated with iron. There are several other localities within the city limits that are said to have chalybeate springs or wells, but no analyses have been made.

FLORIDA.

This State includes the Peninsula of Florida, and comprises an area of 59,268 square miles. The limits of the State extend from 25° to 30° north latitude. The principal rivers are the St. John's, Ocklockonee, Perdido, St. Mary's, Suwanee, and Apalachicola. The surface of this State is generally level, the greatest elevation being not more than 300 feet above tide-water. Numerous lakes and ponds dot the surface of the peninsula. The most remarkable feature is the immense tract of marsh, filled with islands, in the southern part of the State, called the Everglades. The climate may be described as subtropical, the average summer temperature being 80°, the winter varying from 65° to 70°, according to location. The mild, equable climate of the winter months has given the State a wide reputation as a resort for pulmonary complaints. The winter weather of the Gulf Coast is not so mild as that of the Atlantic. The average rainfall is 55 inches. The vegetation is varied, and forests of low saw palmetto, cabbage palm, mangrove, red pine, hickory, white oak, and gum trees, and groves of wild orange occur in different parts of the State. Lemons, limes, pineapples, olives, and grapes also flourish luxuriantly. The latest United States Census Report shows a death-rate for all diseases of 10.50 per 1000, and for phthisis of 0.96 per 1000 of population.

The springs of Florida are remarkable for their great size rather than for the amount of mineral matter they contain. Some of the streams proceeding from them are large enough to float steamboats. Of the few waters which have been analyzed a majority are characterized by the presence of sulphureted hydrogen. Most of the springs in the southern and eastern parts of the State might be classified as weak sulphur waters. In the northeastern portion they appear to be more frequently chalybeate. A majority of the waters are thermal, as they doubtless exceed in warmth the mean annual temperature of their localities. They are used mainly as winter resorts, and, with two exceptions, the waters are not used commercially, so far as can be learned. We have succeeded in obtaining an account of three localities:

BLUE SPRING,

JACKSON COUNTY.

This place is connected with Ocala, being twenty miles distant by the Silver Springs, Ocala and Gulf R. R. No analysis has been made, but the water is said to be remarkably pure and as clear as crystal. It is excellently adapted for the table. Numerous health seekers repair to this vicinity during the winter months to enjoy the rare climatic advantages.

SUWANEE SULPHUR SPRINGS,

SUWANEE COUNTY.

Post-office, Suwanee. Hotel. Suwanee Springs Hotel. Access from all points *via* Savannah, Florida, and Western R. R. to Suwanee, thence one mile to springs. The famous Suwanee River is now open as a regular tourist route, and the traveller for health or pleasure can with ease and comfort visit this romantic stream of legend and song and the attractive resorts located along its banks. The Suwanee Springs Hotel property consists of a beautiful park of massive live-oaks and tall pines to the extent of 100 acres, situated along the river banks and on the picturesque bluffs. In the park the company have built a handsome hotel and eighteen comfortably furnished and conveniently appointed cottages. The visitor need, therefore, have no fear of being subjected to the usual discomforts of a newly settled country. The buildings are well equipped with an excellent system of water-works, and the sanitary appointments are of the first class. The water from the springs are supplied by pipes, either hot or cold, directly from the fountains to the rooms. The springs are located about two hundred yards from the hotel, and immediately on the banks of the river. They boil up from the ground at a rate of 45,000 gallons per hour, and the water exhales a strong, sulphurous odor. Bath-houses are conveniently located along the margins of the springs. An unvarying temperature of the water of 74° F. enables the visitor to bathe in the springs at any season without ill effects. An analysis of the water by Professors Chandler and Pellew, of New York, in 1893, resulted as follows:

SUWANEE SULPHUR SPRINGS.

Alkaline-calcic. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.62
Potassium sulphate	0.60
Calcium sulphate	1.78
Sodium bicarbonate	0.96
Calcium bicarbonate	11.02
Magnesium bicarbonate	3.48
Oxide of iron and alumina	0,15
Silica	0.81
Organic and volatile matter	2.19
Total solids	21.61

The waters are quite heavily charged with sulphureted hydrogen gas, to which they owe much of their virtue. Rheumatism, nervous disorders, dyspepsia, and diseases of the liver, kidneys, and blood are benefited by the waters and baths.

The neighborhood holds forth many attractions to the tourist, not the least being the poetic old Suwanee, which is said to possess more elbows, curves, and angles in a shorter space than any other river in the world. Its banks are carpeted with ferns and mosses, and its dark but clear waters are overarched by a luxuriant tangle of umbrageous foliage. "A trip through the tortuous windings of this stream is indeed one of the most romantic that can be imagined, and when seated in a row-boat on a clear, moonlight evening, floating over the placid surface of the dear old river, one can well imagine the sentiment that inspired the poet who has made the name of Suwanee so famous."

WHITE SPRINGS,

HAMILTON COUNTY.

Post-office, White Springs. White Springs Hotel and boarding-houses. This resort is located along the line of the Georgia Southern and Florida R. R., and is open for visitors all the year round. The surrounding country is hilly in character, and the location of the springs is 125 feet above the sea-level. The spring supplying the mineral water is one of the largest in the world, flowing about 30,000,000 gallons in twenty-four hours.[1] The temperature of the water is 72° F. A bath-pool, 20x30 feet, having a gradual descent from two to eight feet, has been constructed. A qualitative analysis by Prof. N. A. Pratt showed the presence of 109 grains of solid mineral constituents in one U. S. gallon of water, consisting of

Sulphuric acid.
Sodium chloride.
Magnesium.
Lime.
Phosphoric acid.
Oxide of iron.
Potash.
Soda.
Organic matter.

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[1] According to Reports of U. S. Geological Survey.

In addition there are several gases, viz., hydrogen sulphide, carbonic anhydride, and free oxygen and nitrogen. The waters are said to possess considerable value in rheumatism, dyspepsia, scrofula, diseases of the kidneys and bladder, and in nervous exhaustion.

Several of the following springs have been improved, but most of them are still in a state of nature:

BENSON'S SALT SPRING,

VOLUSIA COUNTY.

Enterprise. Flow, 500 gallons hourly. Sulpho-saline. Temperature 74° F. Improved as a resort.

BLUE SPRING,

VOLUSIA COUNTY.

Orange City. Unimproved, but used locally. Is sulphureted, also contains chloride of sodium and sulphate of lime. Temperature 75° F. Discharges 73,920 gallons of water hourly.

CLAY SPRINGS,

ORANGE COUNTY.

Near Apopka. Sulphureted. Enormous flow of water, the basin being so large that steamboats have no trouble in entering it. Used for bathing. Probably slightly thermal.

GREEN COVE SPRINGS,

CLAY COUNTY.

Green Cove Springs. Resort. Sulphureted. Flow, 3000 gallons hourly.

NEWPORT SULPHUR SPRINGS,

WAKULLA COUNTY.

Near St. Mark's. Four in number. Sulphureted. Temperature 70° F. Improved as a resort.

ORANGE SPRING,

MONROE COUNTY.

Orange Springs. Saline-sulphureted. Resort. Flow of water, 5,055,000 gallons hourly.[1] Temperature 73° F.

SILVER SPRING,

Silver Springs, Marion County.

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[1] According to Reports of U. S. Geological Survey.

TARPON SPRINGS,

HILLSBOROUGH COUNTY.

Tarpon Springs. Sulphureted. Three in number. Temperature 70° F. Resort.

WISSON'S IRON SPRING,

HAMILTON COUNTY.

Three miles from White Springs. Resort. Flows 7500 gallons hourly. Chalybeate.

The waters of Magnolia Springs, in Clay County, are used commercially.

GEORGIA.

Georgia is one of the thirteen original States, and comprises within its limits an area of 58,000 square miles. The Blue Ridge and Alleghany Mountains traverse the northwestern portion of the State; from thence the surface gradually slopes to the southeast, where is formed the great Okefinokee Swamp. The principal rivers are the Savannah, Altamahah, Ogeechee, Flint, and Chattahoochee; the confluence of the two last forms the Apalachicola of Florida. Forests of live-oak, Southern pine, cedar, cypress, magnolia, and laurel are numerous, and occupy vast areas. The difference between the climate in Northern and Southern Georgia is very marked, the summers in the former region being invigorating and delightful, while in the latter the heat is often very oppressive. At Atlanta the mean annual temperature is 58.36° F., and at Savannah 67.8° F. The death-rate for 1890 was 11.25 per 1000 of population; phthisical death-rate 1.17 per 1000.

The mineral springs of Georgia are very numerous, and some of them of considerable importance. From various sources the author has secured an account of thirty-two localities. The most complete account of the Georgia springs which has hitherto appeared is contained in a pamphlet published at Macon by Dr. J. R. Duggan, in 1881.

ATLANTA MINERAL SPRING,

FULTON COUNTY.

Post-office, Atlanta. Location, two miles from the city.

According to an analysis by Prof. W. J. Land, the waters of this spring contain the following ingredients, estimated in grains per U. S. gallon :

One U. S. gallon contains:

Solids.	Grains.
Iron sesqui-oxide	10.50
Calcium chloride	4.00
Sodium chloride	2.50
Calcium sulphate	Traces.
Calcium carbonate	"
Iron sulphide	"
Total solids	17.00

The gases are not described, but from the presence of iron sulphide the water may be presumed to contain more or less hdyrogen sulphide. The water is a strong chalybeate and possesses excellent qualities as a ferruginous tonic.

BEALL SPRING,

WARREN COUNTY.

Hotel and cottages. Access *via* Macon and Augusta R. R. to Warrenton, thence by hack line to springs. Location: eight miles south of Warrenton. This spring was discovered in the early part of the present century, and some rude improvements were made as far back as 1825. The following qualitative analysis gives the principal ingredients of the water:

Solids.	Solids.
Calcium carbonate.	Potassium sulphate.
Potassium carbonate.	Magnesium sulphate (trace).
Iron carbonate.	Silica.
Sodium carbonate.	Organic matter combined with sulphur.

Gases. { Hydrogen sulphide, small quantity.
Carbonic anhydride, " "

Sulphureted hydrogen may be considered the most important ingredient. The amount of carbonate of lime is sufficient to exert a considerable influence in diseases of the bladder and kidneys. The quantity of iron is small, but is by no means an unimportant constituent. The combination of ingredients gives the waters many of the advantages of three prominent classes of spring waters, viz., the sulphureted, the chalybeate, and the calcic waters. The flow of water is about 1 gallon per minute. The spring is located on an eminence, and is surrounded by a fine grove. The improvements are not extensive, consisting of a small hotel and a few cottages.

BOWDEN LITHIA SPRINGS,

FULTON COUNTY.

Post-office, Lithia Springs. Sweetwater Park Hotel. Access *via* Georgia Pacific Division of the Piedmont Air-line. These springs are located in Fulton County, seventeen miles west of Atlanta, three hundred miles distant from the Atlantic coast and at an altitude of

1200 feet above the sea-level. The surrounding country is of a somewhat rugged, broken character, interspersed with forests of pine, oak, maple, and cypress and watered by streams skirted by haw and holly. The temperature rarely reaches 90° F. in summer, or extends below 40° above zero in winter, while the nights are proverbially pleasant. The surroundings of the place are exceptionally charming, the Shoals, the Ruined Mill, Chapel Hill, the Dome Rock, showing the mighty action of some great sea in prehistoric times, the Mill in the Glen, the Old Distillery, and the Sweetwater Creek being among the numerous features of interest. The hotel is a first-class modern structure, capable of accommodating 500 guests, and all of the appointments are of a superior order. More than one hundred years ago the locality of the springs was known as the "deer-licks" by the Cherokee Indians, who formerly inhabited this part of the country. The edges of the bowlders in the springs show to-day conclusive evidences that these animals frequented the springs and licked the rocks in order to obtain the saline properties of the water. While people have resorted to these springs for about sixty years, only recently have they become very extensively known.

Following are analyses of the waters:

BOWDEN LITHIA SPRINGS.

One U. S. gallon contains:	Upper Spring.	Lower Spring.	
	Pratt, 1887.	Pratt, 1889.	Doremus, 1890.
Solids.	Grains.	Grains.	Grains.
Carbonic acid as bicarbonates	9.85	...	9.91
Lithium bicarbonate	2.85	1.67	4.45
Potassium bromide	...	5.29	...
Potassium sulphate	...	...	1.73
Potassium bicarbonate	3.36	...	...
Magnesium bromide	1.69	15.23	1.47
Magnesium bicarbonate	10.32	...	...
Magnesium sulphate	4.41	...	...
Magnesium iodide (iodine)	Traces.	0.73	Traces.
Calcium bicarbonate	14.18	...	17.25
Calcium sulphate	...	20.21	12.15
Calcium phosphate	0.64	...	...
Strontium sulphate	1.02	0.28	1.22
Ferrous bicarbonate	0.21	...	0.21
Sodium sulphate	16.25	...	8.03
Sodium chloride	133.71	124.49	121.78
Sodium phosphate	...	0.89	...
Aluminium sulphate	1.33	2.61	0.53
Silicic acid (soluble)	1.12	1.96	1.26
Boric acid	...	...	Traces.
Manganese	Traces.	...	"
Phosphoric acid	...	...	"
Rubidium	Traces by spectroscopic analysis.		
Fluorine	Traces.	...	...
Loss on ignition	...	...	5.75
Totals	200.94	173.36	185.74

The use of the Bowden lithia waters is particularly recommended in kidney and bladder affections, calculi, gravel, cystitis, etc., and in gout and rheumatism. The external use of the water in bathing, for which there are excellent facilities, is said to be beneficial in skin affections, chronic ulcers, glandular enlargements, etc. The waters are used commercially, and may be found in most of the principal cities of the East and South.

CAMP SPRINGS,

FULTON COUNTY.

Post-office, Atlanta. Access *via* West-end cars from Atlanta. This spring is located two miles from the Union Depot in Atlanta. It has been analyzed by Prof. W. J. Land, with the following result estimated in grains per U. S. gallon :

One U. S. gallon contains: Solids.	Grains.
Iron proto-carbonate	2.03
Iron sesqui-carbonate	0.35
Manganese proto-carbonate	0.01
Manganese carbonate	0.05
Calcium carbonate	0.30
Calcium chloride	0.12
Sodium chloride	0.13
Sodium and lime silicate	0.43
Crenic and apocrenic acids	0.02
Total	3.44
Gases.	Cubic inches.
Carbonic acid	2.19
Hydrogen sulphide	0.47

This water is a very fair chalybeate, and contains sufficient sulphureted hydrogen to render it useful in diseases benefited by sulphur waters.

CANNON'S SPRINGS,

WILKINSON COUNTY.

Post-office, Toombsboro. Location on the Central R. R. of Georgia, one mile from Toombsboro and thirty-six miles from Macon.

This spring was once widely known under the name of Myrtle Spring. For want of improvements, however, it has passed into comparative obscurity. Following is a qualitative analysis of the water :

- Iron carbonate.
- Calcium carbonate.
- Magnesium carbonate.
- Magnesium sulphate.
- Sodium chloride.
- Hydrogen sulphide (gas).

This is usually called a sulphur spring, but it is more properly classed as a chalybeate. There is a fair proportion of salts of lime, and the water ought to be useful in kidney and bladder affections. It is said that the only improvements consist of a shelter over the spring.

CATOOSA SPRINGS,

CATOOSA COUNTY.

Post-office, Catoosa Springs. Hotel and cottages. Access from Atlanta and Chattanooga *via* the Western and Atlantic R. R. Distance from north of Atlanta, one hundred and fifteen miles; south of Chattanooga, twenty-six miles. From railroad, two miles.

This resort is nestled among the mountains of North Georgia at an elevation of 945 feet above the sea-level. The aspect of the country is quite rugged, the Sandstone Mountain, about a mile distant, reaching an altitude of 1800 feet above tide-water. From the summit of this mountain may be seen Mission Ridge, the historic Lookout Mountain, and many other points of lesser interest. The hotel and cottages at the springs have room for 600 guests, and are supplied with all modern conveniences. The climate is bracing and invigorating, even in the summer months; in winter it is temperate, and the weather is not subject to sudden changes of temperature. The springs are fifty-two in number, situated within an area of two acres. It is not unusual to find quite different properties even among springs only a few feet apart. Most of them are quite strongly mineralized. The ten principal ones are as follows: The "All-healing," the "Red Sweet," the "Cosmetic," the "Chalybeate," the "Magnesia," the "Congress," the "Alum," the "Black Sulphur," the "White Sulphur," and the "Buffalo." They range in mineral ingredients from about 84 to 104 grains to the U. S. gallon. Following are analyses of three of the springs by Prof. W. J. Land, of Atlanta:

CATOOSA SPRINGS.

Alkaline-saline.

No. 4, or "Chalybeate" Spring.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	41.56
Magnesium sulphate	27.90
Strontium sulphate	0.20
Sodium sulphate	1.59
Potassium sulphate	2.30
Aluminium sulphate	0.67
Calcium carbonate	3.75
Magnesium carbonate	7.48
Iron carbonate	0.19
Manganese carbonate	0.01
Lithium carbonate	Trace.
Strontium carbonate	0.04
Potassium carbonate	0.11
Sodium carbonate	0.26

One U. S. gallon contains:

Solids.	Grains.
Calcium nitrate	0.37
Ammonium nitrate	0.11
Calcium bromide	0.26
Magnesium bromide	0.30
Calcium fluoride	0.02
Sodium chloride	0.14
Crenic and apocrenic acids	0.02
Free sulphuric acid	0.01
Free carbonic acid	4.31
Total ingredients	91.46
Total solid residue upon evaporation at 212° is	90.48

No. 9, "White Sulphur" Spring.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	44.81
Magnesium sulphate	32.01
Strontium sulphate	0.21
Sodium sulphate	1.67
Potassium sulphate	2.32
Aluminium sulphate	2.47
Calcium carbonate	3.85
Magnesium carbonate	8.40
Iron carbonate	0.28
Manganese carbonate	0.02
Lithium carbonate	Trace.
Strontium carbonate	0.04
Potassium carbonate	0.11
Sodium carbonate	0.26
Calcium nitrate	0.32
Ammonium nitrate	0.10
Calcium bromide	0.15
Magnesium bromide	0.31
Calcium fluoride	0.02
Sodium chloride	0.14
Crenic and apocrenic acids	0.01
Free sulphuric acid	6.13
Free carbonic acid	4.51
Hydrosulphuric acid[1]	0.02
Total ingredients	108.16
Total residue upon evaporation at 212° is	88.94

No. 10, "Buffalo" Spring.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	45.00
Magnesium sulphate	33.02
Strontium sulphate	0.29
Sodium sulphate	1.67
Potassium sulphate	2.31
Aluminium sulphate	2.39
Calcium carbonate	3.86
Magnesium carbonate	8.70
Iron carbonate	0.28

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[1] This is the strongest sulphur spring in the group.

One U. S. gallon contains:

Solids.	Grains.
Manganese carbonate	0.12
Lithium carbonate	Trace.
Strontium carbonate	0.04
Potassium carbonate	6.01
Sodium carbonate	0.03
Calcium nitrate	0.03
Ammonium nitrate	0.91
Calcium bromide	0.15
Magnesium bromide	0.33
Calcium fluoride	0.01
Sodium chloride	0.11
Crenic and apocrenic acids	0.01
Free sulphuric acid	0.13
Free carbonic acid	4.62
Hydrosulphuric acid[1]	Trace.
Total ingredients	110.02
Total solid residue upon evaporation at 212° is	100.11

All of these springs boil up through the hard black slate of the mountain side. They are perennial, the most severe and persistent droughts causing no perceptible difference in the rate of their flow. The waters are recommended for stomach, kidney, and bowel disorders, and for debility. The "All-healing" Spring is used for local troubles. The waters are shipped on order in bottles or barrels to any part of the country.

CHALYBEATE SPRINGS,

MERIWEATHER COUNTY.

Post-office, Chalybeate Springs. Hotels and cottages. Access: Take Southeastern R. R. to Bostwick, thence Talbottom Branch Road to Talbottom, thence twenty miles west to springs.

These springs were discovered by Mr. Rawlings about 1835, and opened by him for the reception of visitors a few years later. The improvements were of a rude character until about 1850, at which time they were considerably enlarged. With the exception of a few years' interval they have been open to the public ever since. Analysis by Prof. W. J. Land:

One U. S. gallon contains:

Solids.	Grains.
Silicic acid (soluble)	2.83
Iron proto-carbonate	0.62
Iron sesqui-carbonate	0.17
Lime carbonate	0.76
Potassium sulphate	0.33
Sodium sulphate	0.13
Aluminium sulphate	0.43
Sodium chloride	0.03
Total	5.30

Carbonic acid gas, 6.55 cubic inches.

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[1] This spring contains more saline matter than any of the other springs.

The water is a light chalybeate. There are also traces of hydrogen sulphide, carbonate of magnesia, crenate of iron, and a minute trace of nitric acid, lithium, and organic matter. The proportion of soluble salicylic acid is larger than usual. This compound is not used in medicine, but silica is contained in the human body, and may not be without therapeutical value. It is possible that the trace of sulphureted hydrogen also slightly influences the action of the water. It has been recommended in all cases requiring a chalybeate water. The flow is abundant, being about 25 gallons per minute. Near by is a sulphur and magnesia spring, but no analysis has been made of the waters. The improvements are extensive, consisting of two hotels and cottages, sufficient to accommodate 500 guests. Bathing facilities are ample, both hot and cold water being supplied. The climate of this region is of a salubrious character.

CLAREMONDE CHALYBEATE SPRING,

Washington County.

Post-office, Worthen. Access *via* Georgia Central R. R. to Tennile; thence by Sandersville and Tennile R. R. three miles to Sandersville; thence by private conveyance nine miles to Worthen. Following is a qualitative analysis of the water :

Iron carbonate.
Potassium carbonate.
Calcium carbonate.
Potassium sulphate.
Sodium chloride.
Alumina (trace).

The iron carbonate is present in the proportion of about 4 grains per gallon. The quantity of other ingredients is small. This is a very good chalybeate water, and will no doubt be found beneficial in all diseases in which the carbonated iron waters are indicated. The spring is pleasantly located in a private park.

COHUTTA SPRING,

Murray County.

Access *via* Western and Atlantic, or Rome and Dalton R. R., to Dalton; thence by private conveyance eighteen miles to spring. No reliable account of this spring could be secured. The waters are said to be chalybeate, but the resort seems to be on the decline on account of difficulty of access.

FERRO-LITHIC SPRING,

Clarke County.

Post-office, Athens. Access *via* Athens Branch of Georgia R. R. or by Northeastern R. R. to Athens. This spring was discovered comparatively recently, but it has already obtained considerable local reputation. Prof. H. C. White has examined the water, and states that it is quite similar to that of the Helicon Spring in the same county, but contains less iron and distinct traces of lithia. The spring is said to be used to good advantage by persons living in the neighborhood.

FRANKLIN SPRING,

FRANKLIN COUNTY.

Post-office, Royston. Access *via* Elberton Air-line R. R. to Royston, thence two miles by hack line to springs. This spring has had considerable reputation as a resort for invalids as far back as the oldest citizen can remember. Qualitative analysis :

Iron carbonate.
Calcium sulphate.
Magnesium sulphate.
Sodium chloride.
Aluminium sulphate.
Potassium sulphate.
Iron proto-sulphate.
Sulphureted hydrogen gas.

This water contains sufficient aluminium to render it valuable in chronic diarrhœa and dysentery, and useful as a local application in ulcerative skin diseases. The deposit of iron in the spring was used to some extent during the late war to supply the place of copperas. The temperature of the water is 60° F., and the flow 2½ gallons per minute. The climate is good, and near by is some very fine mountain scenery. There are facilities for bathing, and the neighborhood offers numerous features of interest.

SPRINGS IN THE VICINITY OF GAINESVILLE,

HALL COUNTY.

The town of Gainesville is located on a small table-land 1300 feet above the sea-level, and lies between the headwaters of the Oconee River, which flows into the Atlantic, and those of the Chattahoochee, which finds its way to the Gulf. The Alleghanies, stretching around the place to the north and west, form a natural bulwark which breaks the force of the northern winds of winter. The town thus enjoys a dry, bracing climate, without extremes of either heat or cold. Daily observation made for the United States Signal Service during the period of ten years showed a mean winter temperature of 44° F. and a mean summer temperature of 71° F. The health tables of the United States Census show a lower death-rate in this portion of Georgia than in any other section of the country. White, in his *Statistics of Georgia*, makes the statement that no case of consumption was ever known to originate in Hall County. In close proximity to the thriving and rapidly growing little city are numerous mineral springs, some of which have come into use as health resorts. We have thought it advisable to consider these springs in the following group :

Gower Springs form one of the chief attractions of the city.

They are located just beyond the corporate limits and are connected with the city by a street-car line. These springs are chalybeate in character, the iron being held in solution by carbonic acid, which makes it readily assimilable. The following qualitative analysis was made some years ago by Prof. W. J. Land, of Atlanta :

Free carbonic acid.
Hydrosulphuric acid
Iron carbonate.
Manganese carbonate.
Iron apocrenate.
Potassium sulphate.
Sodium sulphate.
Iron crenate.
Lithium phosphate.
Calcium sulphate.
Magnesium sulphate.
Potassium bromide.
Oxygen gas.
Nitrogen gas.

An excellent hotel is maintained at the springs, and we are informed that an increased number of visitors come to the springs every year. The waters are recommended in general debility, digestive orders, and kidney affections.

The **Deal Spring**, located two miles from the city, wells up in a basin of solid rock, and is said to possess excellent properties in the treatment of indigestion and dyspepsia and in the dentition period of children.

The **New Holland Springs** are also within two miles of Gainesville, immediately on the Southern R. R. (formerly Richmond and Danville R. R.), with a station at the springs. The improvements consist of a hotel and cottages for 200 guests. The situation is in a beautiful and extensive grove of native oaks, and the springs furnish about 200 gallons of water per minute. The water is recommended for indigestion and general debility, but we are unable to present a complete analysis in verification of its claims. An old qualitative examination showed the presence of the following ingredients :

Calcium carbonate.
Magnesium carbonate.
Potassium carbonate.
Iron, probably combined with carbonic acid.
Sodium chloride.
Carbonic acid gas.

GORDON SPRINGS,

Whitfield County.

Post-office, Gordon Springs. Access *via* Western and Atlantic R. R. to Dalton or Tunnel Hill, thence by private conveyance. These springs supply a good chalybeate water, and enjoyed an extensive reputation before the war, but the resort has since been allowed to decline. It is hoped that they will again be opened to the public, as, in addition to the advantages of the water, is added a pleasant and salubrious climate.

HUGHES MINERAL WELL,

Floyd County.

Post-office, Rome. This well is located about one mile and a half from the business centre of the city of Rome, on Shorter

Avenue, one of the most beautiful driveways about the city. An analysis of the water in 1887 by Prof. H. C. White, State Chemist, resulted as follows:

HUGHES' MINERAL WELL.

Saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	58.31
Magnesium sulphate	10.19
Sodium sulphate	1.54
Potassium sulphate	2.62
Aluminium sulphate	1.02
Calcium carbonate	8.63
Iron carbonate	0.22
Sodium chloride	2.56
Silica	0.77
Organic matter and combined water	0.57
Lithia	Traces.
Bromides	"
Total solids	86.43

This is a very strong mineral water, and may be ranked as a calcic-saline-chalybeate. It will be seen that a close resemblance exists between this water and that of the Montvale Springs, in Tennessee, and several of the Catoosa Springs. The analysis would indicate a wide range of usefulness. It has sufficient Epsom salts to give it aperient qualities, while the other saline and calcic ingredients should make it diuretic; at the same time iron is present in sufficient quantity to impart to the water a tonic and reconstructive influence. All of these effects have been observed in actual experience, and the water has come to be recommended in a variety of conditions by the physicians of Rome and the surrounding country. The water is also used commercially.

INDIAN SPRING,

BUTTS COUNTY.

Post-office, Indian Springs. Several hotels in village. Access *via* Macon and Western R. R. to Forsyth, thence by stage-line to spring. This celebrated spring received its name on account of its great reputation as a medicine spring among the Indians. In the treaty of 1821, when all this portion of Georgia was ceded to the whites, a special reservation of 1000 acres, including Indian Spring, was made by the Creek Nation. This, however, was given up to the whites a few years later. In 1823 General McIntosh erected a small hotel, which is still used for its original purpose (Duggan). A village of three hundred or more inhabitants has sprung up in the neighborhood. The following analysis was made by Prof. A. A. Hayes, a number of years ago:

One U. S. gallon contains 648.03 grains of solid matter, consisting chiefly of the following ingredients :

Magnesium sulphate.
Magnesium carbonate.
Calcium sulphate.
Potassium sulphate.

Gases.	Carbonic acid . .	2.61 cubic inches per gallon.
	Hydrogen sulphide .	1.05 " " " "

The water contains an exceedingly large amount of sulphate of magnesia or Epsom salts. When to this is added the considerable quantity of other sulphates we have a very valuable mineral water. There is sufficient calcium sulphate to exert a useful influence in diseases of the urinary apparatus and also to modify the purgative effects of the sulphate of magnesia. Among the numerous affections in which the water has been found useful may be mentioned dropsical affections when not due to heart disease, rheumatism, and tertiary syphilis.

LEGG'S SPRINGS,

JACKSON COUNTY.

Post-office, Jefferson. Access: Take private conveyance at Maysville or Harmony Grove, on the Northeastern R. R. The springs were discovered by Mr. F. H. Legg, in 1856, and improved to a small extent in 1866. A qualitative analysis by Prof. W. J. Land gives the following ingredients :

Iron proto-carbonate.
Magnesium proto-carbonate.
Potassium carbonate.
Sodium carbonate.
Calcium carbonate.
Magnesium carbonate.
Lithium carbonate.
Sodium chloride.
Potassium chloride.
Carbonic acid gas.
Sulphureted hydrogen gas.

The water may be classed as a chalybeate.

MADISON SPRINGS,

MADISON COUNTY.

Post-office, Madison Springs. Access: Take Elberton Air-line R. R. to Royston, thence private conveyance to springs.

This place was once a popular resort, but of late years the springs are said to be but little visited. The waters are supposed to be chalybeate.

MAGNOLIA SPRING,

SUMTER COUNTY.

Post-office, Plains of Dura. Access *via* Southwestern R. R. to Americus, thence by private conveyance to spring.

This spring has been known for many years, and has been steadily gaining in popularity as a place of local resort. No analysis of the water has been made, but it is said to contain iron and sulphur.

There is some gas given off, probably carbonic acid. The iron is in sufficient quantity to impart its taste very distinctly to the water. The flow is large, being about 50 gallons per minute. There is a good bath-house, and visitors can find accommodations in private families.

OCONEE CHALYBEATE SPRING,

PUTNAM COUNTY.

Post-office, Eatonton. Take Eaton branch of Central R. R. to Eatonton, and from thence private conveyance to spring.

This spring has had considerable local reputation for a number of years. The waters contain the following ingredients:

Iron carbonate.
Calcium carbonate.
Potassium sulphate.
Calcium sulphate.
Sodium chloride.
Silica.

The iron is in sufficient quantity to place the water in the chalybeate class. The flow is small but constant, the water issuing from a fissure in a granite rock.

OCONEE WHITE SULPHUR SPRINGS,

HALL COUNTY.

Post-office, Bowdre. Hotel and cottages. Location six miles from Gainesville and two miles from Sulphur Springs Station, on the Southern (Richmond and Danville) R. R. Hacks meet all trains.

This is one of the most attractive watering-places of the South. Long before the war Southerners of wealth and fashion gathered there annually. A few years since the property was purchased by Mr. Ferdinand Phinizy, of Athens, and many improvements made. The old buildings were torn down and a large, well-appointed hotel with handsome cottages erected. The excellent and liberal management has kept the place popular, and it now numbers among its guests visitors from far and near. No analysis is furnished, but the waters are said to be exceedingly valuable in rheumatism, dyspepsia, and diseases of the blood. There are also bathing conveniences, including shower and plunge-baths and a large swimming pool.

PONCE DE LEON SPRING,

FULTON COUNTY.

Location two miles notheast of Atlanta, on the Atlanta and Richmond Air-line.

This spring is said to have been discovered in 1871. No analysis has been made of the water, but it is known to be chalybeate. A large quantity of free carbonic acid is given off from the surface.

It has been found useful in dyspepsia, diseases of the bladder and kidneys, and other affections.

PORTER SPRINGS,

LUMPKIN COUNTY.

Post-office, Porter Springs. Hotel. Access *via* tri-weekly hack line from Gainesville, the springs being twenty-eight miles north of that city and ten miles north of Dahlonega.

They were discovered only a few years since in a beautiful cove on the Southern slope of the Blue Ridge Mountains. The waters have acquired an extensive reputation on account of their valuable chalybeate properties. The hotel has a capacity for about one hundred and fifty guests, and is kept open from June 15th to October 15th. The situation is very high for this region, being more than 3000 feet above the sea-level, an elevation greater than the top of Lookout Mountain. Some of the peaks in the vicinity reach an altitude of almost 5000 feet. Although located in a semi-tropical latitude, the high elevation of Porter Springs gives the climate an invigorating, bracing character not subject to exhausting heated spells. The waters are said to contain, besides iron, hdyrogen sulphide gas, with sulphates of magnesia, potassa, and soda. Some of the springs contain also small quantities of iodine, lithia, and manganese. It is unknown by whom these determinations were made. A proper quantitative analysis is needed.

POWDER SPRINGS,

COBB COUNTY.

Post-office, Powder Springs. Access: Take Western and Atlantic R. R. to Marietta, and from thence private conveyance to the springs, ten miles distant.

These springs were discovered about fifty years ago, but for want of improvements their reputation has been confined to the surrounding country. There are four springs, one of which has been approximately analyzed as follows:

One U. S. gallon contains:

Solids.	Grains.
Iron sulphate	2.00
Calcium sulphate	1.00
Iron oxide	1.50
Gases.	**Cubic inches.**
Carbonic acid	1.00
Hydrogen sulphide	1.50

The other springs contain about the same ingredients. The flow of water is about 2½ gallons per minute. The water is evidently quite a strong chalybeate.

ROWLAND SPRINGS,

BARTON COUNTY.

Post-office, Cartersville. The resort is located five miles northeast of Cartersville, on the Western and Atlantic R. R., and fifty miles from Atlanta.

Before the war it was very popular, and accommodations for 500 or 600 guests were maintained. The springs have not been so extensively patronized since the war. There are now accommodations for about one hundred people. The springs are four in number, and are said to contain iron, sulphur, and magnesia. They are located in a picturesque, broken country, and are surrounded by grounds of about 1000 acres in extent, containing beautiful groves and running brooks. The summer season is not excessively warm, while the nights are always cool. The weather in summer is unusually clear, there being an average of about one shower weekly. The waters of the springs are said to be efficacious in diseases of the stomach and kidneys.

THUNDERING SPRING,

UPSON COUNTY.

Post-office, Thomaston. Access: Take Macon and Western R. R. to Barnesville, thence the Thomaston Branch R. R to Thomaston, and from thence private conveyance ten miles northwest to springs.

The spring takes its name from the rumbling noise made by the escape of gas, which, though now scarcely perceptible, is said to have been very loud at one time. Two hotels have been built at different periods, but both were lost by fire. The water is slightly warm, but the exact temperature is not known. The spring has been regarded more as a curiosity than a health resort, as it is not highly mineralized, containing, it is said, only a trace of borate of soda. The nature of the escaping gas has never been ascertained. The flow of water is very large, being estimated at 100 cubic feet per minute. Owing to the presence of borax, the water may find an application in the treatment of skin diseases.

Not far from this spring is the gorge of Pine Mountain, called Dropping Rock, through which passes the Flint River.

TRENTHAM SPRING,

CAMPBELL COUNTY.

Post-office, Fairburn. Access *via* Atlanta and West Point R. R. to Fairburn, thence by private conveyance three miles north to spring.

For a number of years this spring has had considerable local reputation. The principal ingredients of the water are as follows :

Calcium carbonate.
Magnesium carbonate.
Iron carbonate.
Potassium carbonate.
Magnesium sulphate.
Sodium chloride.
Alumina.
Organic matter.

The waters of this spring are said to be highly efficacious in the treatment of syphilis and scrofula.

WARM SPRINGS,

MERIWEATHER COUNTY.

Post-office, Warm Spring. Hotel. Access: From Atlanta, Columbus and Macon *via* Georgia Midland and Gulf R. R. The hotel is half a mile from the railroad station. Conveyances meet every train.

This watering-place is located on a spur of Pine Mountain, at an elevation of 1200 feet above the sea-level. The surface of the surrounding country is mountainous and very picturesque. It has a pure sandstone foundation with perfect drainage, and is quite free from mud, dust, or malaria. A large modern hotel, with every convenience and furnished throughout with entirely new equipments, has recently been completed. We are informed that a new and complete system of water-works now renders available for lavatory, bathing, and drainage purposes 300,000 gallons of the spring water daily. The hotel is charmingly environed by a tastefully arranged series of lawns, drives, and beds of bright flowers. Magnificent oaks and resinous pines give ample shade for promenades as well as play-grounds for children. The pre-eminent feature of the place, however, is the great Warm Spring, gushing from the base of Pine Mountain at the rate of more than 2,000,000 gallons daily, without variation from flood or drought. The water is beautifully limpid and has a temperature of 90° F. Besides a commodious system of baths, the spring also supplies two magnificent swimming-pools, 40x15 feet each, and varying in depth from three and one-half to five feet. Connected with each pool is also a soap bath. Following is a recent analysis of the water by H. C. White, State Chemist:

WARM SPRING.

Light Calcic-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	6.10
Magnesium carbonate	0.10
Iron carbonate	0.09
Calcium sulphate	0.55
Sodium sulphate	0.86
Potassium sulphate	0.25
Sodium chloride	0.01
Alumina	0.46
Silica	1.41
Organic matter and combined water	0.87

One U. S. gallon contains :

Solids.	Grains.
Iodine	Trace.
Bromine	"
Total	10.70

Carbonic acid gas dissolved, 7.75 cubic inches.
Sulphureted hydrogen gas, a trace.

These waters possess medical qualities for both internal and external use. They are said to be very efficacious in dyspepsia and rheumatism and in hepatic, renal, and cutaneous affections. In cases of general debility the use of the waters, aided by the bracing mountain atmosphere, conduces to a rapid re-establishment of health and strength.

WATSON'S SPRINGS,

GREENE COUNTY.

Post-office, Maxey's. Boarding-houses and cottages. These springs are located eleven miles north of Greensboro, on the Georgia R. R., and eight miles west of Maxey's Depot, on the Athens branch of the Georgia R. R. The group is one-quarter of a mile from the Oconee River, which will be navigable at this point when the government works on the river are completed. The springs are reached by private conveyance from the points above mentioned. The scenery in the neighborhood of the springs is varied and the climate delightful, the temperature rarely falling below the freezing-point in winter or rising above 90° F. in summer (95° F. is the highest temperature known). The springs are four in number, viz.: the "Sulphur" Spring, the "Chalybeate," the "Alum," and the "Ice" Spring. The following partial analysis of two of the springs was made some years ago by Dr. J. R. Duggan :

SULPHUR SPRING.

Solids.
Calcium carbonate.
Potassium carbonate.
Iron carbonate.
Potassium sulphate.
Sodium sulphate.

Solids.
Sodium chloride.
Silicic acid.
Hydrogen sulphide gas.
Carbonic acid gas.

Temperature of water, 59° F.

CHALYBEATE SPRING.

Solids.
Iron carbonate.
Magnesium carbonate.
Sodium chloride.

Solids.
Potassium sulphate.
Calcium sulphate.
Silica.

Temperature, 61° F.

The "Ice" spring has not been analyzed, but its waters are delightfully cold and refreshing and palatable at all times. The sulphur and chalybeate springs yield about one gallon of water per minute. Their waters are stated to be highly efficacious in rheumatism and dyspepsia, and in renal, cutaneous, and blood diseases.

The following springs of Georgia have also been used as resorts:

Daniel Mineral Spring, Union Point, Greene County.

Garnet Springs, near Toccoa Falls, Habersham County.

Glen Ella Springs, Tallulah Falls, Rabun County.

IDAHO.

Idaho extends from 42° to 49° north latitude and from 111° to 117° west longitude, and comprises an area of 86,294 square miles. The Bitter Root Mountains, a chain of the Rockies, form the northeastern boundary, and their spurs and extensions occupy a considerable portion of the surface. The rivers of the State, with the exception of the Bear River, are tributaries of the Columbia. The climate is cool and healthful, the mean annual temperature being 52.46° F. Vast forests of red fir, white pine, white cedar, hemlock, tamarack, and larch are interspersed over the surface. The mortality-rate for 1890 was only 9.14 per thousand. There were but thirty-six deaths from phthisis in the State, showing the remarkably small phthisical mortality-rate of 0.43 per thousand of population.

The chemical composition of the mineral springs of Idaho is so little known that they cannot be definitely classified beyond stating that thermal springs predominate. Granite and volcanic rocks prevail, and, in connection with the mountain corrugation, present most favorable conditions for the development of hot and warm springs. Although few of the springs have been improved, a great many are used extensively for bathing purposes, especially in the mining regions. It is said that several of the springs have been recently developed, but numerous letters addressed to different parts of the State, as well as a consultation of all the available sources of information, have yielded an account of but two localities.

IDAN-HA SPRING,

BANNOCK COUNTY.

Post-office, Soda Springs. Hotels: Idan-ha, Carriboo, Stock Exchange, and Williams.

The Idan-ha Spring is located two miles from Soda Springs, from whence it is reached by a good roadway. The situation of the spring is 5886 feet above the sea, and the surrounding mountain scenery is of a grand and impressive character. The climate is very salubrious, the weather being, as a rule, clear and bright. The town of Soda Springs has long been known as a health resort.

Within the town limits are the following-named springs: the "Horseshoe," "Octonagon," "Williams," "Soda," "Mount," and "Blanche" Springs. In the outlying districts are the "Mammoth," "Steamboat," "Hooper," "Jews-harp," and "Fresh Water" Springs. The latter supplies the town with water by a pipe line. Close to the Idan-ha (which is known as the "90 per cent.") are the "100 per cent.," the "80 per cent.," and the "Champagne" Springs. An extensive bottling establishment has been built in connection with the Idan-ha Spring, and the waters are shipped and sold in all parts of the country. It is charged with carbonic-acid gas from the Mammoth Spring, two and one-half miles east of Idan-ha, which supplies an immense amount of this substance. The following analysis was made by Prof. Charles F. Chandler:

IDAN-HA SPRING.

Alkaline-saline. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	13.19
Sodium bromide	Trace.
Lithium bicarbonate	1.27
Sodium bicarbonate	7.34
Magnesium bicarbonate	62.40
Calcium bicarbonate	57.96
Strontium bicarbonate	Trace.
Barium bicarbonate	0.08
Manganese bicarbonate	1.73
Iron bicarbonate	0.12
Potassium sulphate	1.72
Sodium sulphate	1.96
Sodium phosphate	0.68
Sodium biborate	Trace.
Alumina	0.05
Silica	3.56
Organic matter	Trace.
Total solids	152.06

This water also contains an excess of free carbonic acid gas.

The analysis shows an excellent alkaline-saline water with ferruginous properties. It should possess valuable properties as a diuretic, mild aperient, and tonic. It is very pleasing to the taste, and possesses the desirable quality of blending with wines and liquors without giving discoloration or precipitation.

WARM SPRINGS,

BOISE COUNTY.

Post-office, Idaho City. These springs are located two miles southwest of Idaho City and thirty-three miles from Boise City. The latter point is reached by the Oregon Short-line R. R., from whence a stage route extends to Idaho City. The springs are located in a mountainous region, at an altitude of 3940 feet above the sea-level. The winters are cold, but the summer months are clear, dry, and bracing. No complete analysis has been made, but we are informed that the waters contain iron, soda, and sulphur, besides other ingredients. Five of the springs have a small flow of water, but a sixth yields enough to turn a large wheel. The temperature is 110° F., and in the form of baths the waters are said to be very useful in rheumatism and skin affections.

The following-named springs of Idaho have so far received little or no attention:

Bruneau Hot Springs, Bruneau Valley, Owyhee County. Temperature 105° F.; flow, 70,000 gallons per hour; used by settlers for bathing.

Given's Hot Springs, Snake River, Owyhee County. Two springs; flow, 2000 gallons per hour. Temperature 98° F.; used to a small extent for bathing.

Warm Sulphur Springs, near Lincoln Lake; sulphureted.

It is probable that other springs of Idaho will be brought into use as the State becomes more thickly settled.

ILLINOIS.

The limits of this State extend from 37° 3′ to 42° 30′ north latitude and from 87° 30′ to 91° 40′ west longitude, and embrace an area of 55,410 square miles. The surface is generally level, sloping gently from north and east toward the Mississippi and Ohio Rivers. It is, however, by no means an unbroken plain, as the many streams which flow through the State have cut deep beds in the yielding alluvial soil, forming in places precipitous slopes and bluffs. The principal rivers are the Mississippi, which flows along the western border; the Illinois, which intersects the State laterally; Rock River, in the north; the Ohio, on the southern border; the Kaskaskia, Wabash, Fox, Spoon, Mackinaw, Embarras, and Vermilion, besides many smaller streams. The climate is variable, and is marked by great extremes, the summers being warm and the winters very cold. The mean annual temperature is about 52° F., that of summer being 75° F., and of the winter 28° F. The climate is generally salubrious, except in the low, swampy bottoms, where malarial disorders are frequent. The average annual rainfall is about 35 inches. The mortality-rate computed from the United States Census for 1890 is 13.88 per 1000 of population; phthisical rate, 1.49 per 1000 of population. The State has quite a number of mineral springs, although but few of them have acquired much reputation. Iron, sulphur, and saline waters predominate. Brine springs are found in some of the counties. Comparatively few of the Illinois mineral waters have been chemically examined.

AMERICAN CARLSBAD SPRINGS,

WASHINGTON COUNTY.

Post-office, Nashville. Hotel Carlsbad. These springs are located in Nashville, a well-built little city of 3000 inhabitants, fifty miles from St. Louis, Mo. Both the Louisville and Nashville and the Chester and Centralia R. R. pass this point. The Carlsbad is a modern hotel, with all of the approved comforts and conveniences. It was erected in 1893, and is located within the city limits, in a natural park of twenty-three acres, with a lake for boating and fishing. It is well furnished throughout, heated with steam and lighted by electricity. The bath-house has separate apartments for ladies and gentlemen, with porcelain bath-tubs and arrangements for steam, vapor, and shower baths. The surrounding country is of a very attractive character, abounding in delightful drives, picturesque walks, etc. The following analysis was made by Dr. Ludeking, of St. Louis:

AMERICAN CARLSBAD SPRINGS.

Sulphated-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	10.0
Calcium sulphate	65.8
Sodium sulphate	53.0
Magnesium sulphate	103.7
Sodium carbonate	27.4
Total	259.9

Carbonic acid gas, not determined.

An analysis by W. F. Hillebrand, Acting Chief Chemist of the Interior Department at Washington, shows the sulphate of soda to be greatly in excess of the magnesium sulphate. According to Hillebrand's analysis, these waters are very similar to those of the Sprudel, Mühlbrunn, and Schlossbrunn Springs at Carlsbad. They are undoubtedly valuable for medicinal purposes, having potent cathartic and diuretic properties. They should be useful in the various diseases known to be benefited by this class of waters, viz., torpid states of the liver, chronic constipation, rheumatism, renal, and urinary disorders, eczematous skin affections, etc.

GREEN LAWN SPRINGS,

JEFFERSON COUNTY.

Post-office, Mt. Vernon. Hotels and boarding-houses. These springs are located in the city of Mt. Vernon, seventy-six miles east of St. Louis. This point is reached by the L E. and St. Louis, the Jacksonville and Southeastern, and by the Louisville and Nashville R. R. The springs are six in number, and are surrounded by a park of about eight acres in extent in the centre of the city. Their waters are discharged from a vertical stratum of slate about eight inches in width and bisecting a horizontal stratum of slate of between two and three feet in thickness. They belong to the class known as saline-chalybeate waters, each spring differing somewhat in properties from its fellow. The one most used, known as the "Washington" Spring, contains the carbonates of lime, iron, and magnesia, bicarbonates of soda and potash, and chloride of sodium, with traces of iodine and bromine. Free sulphurous acid is present in considerable quantities, and the water is quite heavily charged with carbonic-acid gas. The temperature of all the springs is about 56° F., except one, which ranges about 10° higher. The latter has been used for bathing purposes in rheumatism, with good results. A peculiarity of the Washington or Main Spring is its eccentric behavior, which seldom fails about the time of the autumnal equinox. It is said that the waters always become turbid at these periods, and the same disturbances have been observed after great storms or earthquakes, even though in regions remote from the springs. The waters are said to remain red with an excess of iron for a short time after these disturbances, and then to become harsh and acrid from an excess of alkaline ingredients. The country surrounding Mt. Vernon is about equally divided between prairie and timber, a considerable portion of the latter being found on elevated ridges. On the north a belt of timber, about ten miles in depth, affords protection against the winds of winter and causes a considerable modification of temperature. The waters of the Main Spring are very efficacious in the treatment of dyspepsia, torpid liver, biliousness, and other disorders of the chylopoietic organs.

HYGIENIC SPRINGS,

Union County.

Post-office, Western Saratoga. This resort is reached by way of the Illinois Central R. R., from which it is about five and one-half miles distant. The location is in a well-timbered, broken country, with a climate very similar to that of Washington, D. C. The waters of the spring have had considerable reputation in the treatment of stomach and intestinal affections and in syphilis; but since the loss of the hotel by fire several years since the resort has been neglected. It is said that the building of a new hotel and the redevelopment of the springs offer an excellent opportunity for a person with a small amount of capital.

MAGNESIA SPRING,

KANE COUNTY.

Post-office, Montgomery. This spring is located on the main line of the Chicago, Burlington and Quincy R. R., forty miles from Chicago. It is not a resort, but the water is sold in large quantities. The following analysis was made by Walter S. Haines, Professor of Chemistry at the Rush Medical College. The estimate was evidently made in grains per U. S. gallon :

MAGNESIA SPRING WATER.

Alkaline-saline.

One U. S. gallon contains :

Solids.	Grains.
Potassium sulphate	0.20
Sodium sulphate	1.32
Sodium chloride	0.19
Sodium bicarbonate	34.45
Ammonium bicarbonate	0.11
Calcium bicarbonate	1.34
Magnesium bicarbonate	0.70
Iron bicarbonate	0.02
Lithium bicarbonate	0.01
Sodium borate	0.12
Sodium bromide	Trace.
Sodium phosphate	"
Alumina	0.09
Silica	0.37
Total solids	38.92

The water is a good diuretic, and it is said to be valuable in rheumatism and the gouty diathesis.

MINI-NI-YAN SPRINGS,

KENDALL COUNTY.

Post-office, Bristol. Accommodations at private residences. The village of Bristol is located on the main line of the Chicago, Burlington and Quincy R. R., forty-seven miles from Chicago.

Five springs exist within a short distance of each other, but only two have been used medicinally. No. 5, the principal one (an artesian spring), yields 10,000 gallons a day, which can be increased to 100,000 by pumping. Two analyses have been made, the first by the chemist of the State University and the second by the chemist of the C., B. and Q. R. R. Both of these analyses have been lost. We are informed by Mr. G. G. Hunt, the proprietor, that the water contains about 92 grains of solid matter per U. S. gallon, consisting principally of the carbonates of sodium, magnesium, iron, calcium, and lithium, and the phosphate of lithium. It is also said to contain small but perceptible quantities of iodine, bromine, and manganese. The water is said to exert a very favorable influence in cases of nervousness, headache, insomnia, and functional disorders of the liver and kidneys. In the form of a hot bath it has been found decidedly efficacious in painful swellings of the joints, glandular enlargements, and rheumatic and gouty conditions.

PERRY SPRINGS,

PIKE COUNTY.

Two hotels, capacity 350. Access *via* Wabash R. R. to Griggsville or Perry Station, thence by hack nine and six miles, respectively; also from St. Louis *via* Illinois River to Naples, seven miles distant, where steamers land daily.

This attractive health and pleasure resort is located among a beautiful range of hills on the west bank of the Illinois River. The surrounding country is covered by luxuriant forests and intersected by numerous deep ravines, narrow valleys, and clear, winding streams. The romantic character of the whole region is conducive to outdoor exercise, exerting a refreshing and invigorating influence on all who come. The extreme temperature ranges are 100° F. in summer to — 20° F. in winter. The climate is moderately dry and clear most of the time. The springs are three in number, and are located about two hundred yards from each other. The temperature of the water ranges from 50° in summer to 48° in winter. The water from the iron spring is supplied, hot or cold, to fourteen bath-rooms. The following table contains the analysis of the three springs, as furnished by Dr. Engleman, No. 1 being the iron, No. 2 the magnesia, and No. 3 the sulphur springs :

PERRY SPRINGS.

One U. S. gallon contains: Solids.	No. 1. Grains.	No. 2. Grains.	No. 3. Grains.
Calcium bicarbonate	15.89	19.75	19.66
Magnesium bicarbonate	17.01	14.81	10.49
Iron bicarbonate	0.55	0.40	0.27
Aluminium silicate	. . .	. . .	0.27
Potassium and sodium silicate	2.64	2 28	3.45
Sodium silicate (salt)	6.12	0.38	0.58
Sodium sulphate	0.44	1.10	1.49
Potassium carbonate	1.59	1.45	1.46
Total	38.24	40.17	37.67

No organic matter.

The waters are said to be of considerable efficacy in stomach, liver, and kidney troubles.

ZONIAN SPRINGS,

KANE COUNTY.

These springs are three or four in number, and are located one mile north of the city of Elgin, in a fine, wooded, rolling country, about 2000 feet above the sea-level. The temperature of the weather varies from about 75° or 80° F. in summer to 10° to 60° F. during the winter months. The following analysis of the water was made by J. E. Seibel, analytical chemist, Chicago:

ZONIAN SPRINGS.

Light Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	9.56
Iron carbonate	0.49
Magnesium carbonate	2.49
Sodium carbonate	0.45
Sodium sulphate	1.74
Sodium carbonate	0.70
Silica and aluminium	0.26
Total	15.69

It is stated that the water also contains 6.82 grains of free carbonic acid to the gallon. The flow of water amounts to about one barrel per minute from each spring. Kidney, stomach, and liver troubles are said to be benefited by the waters.

The following Illinois springs have also been used as resorts. Some of them have gone out of use:

Alcyone Mineral Springs, Western Springs, Cook County. Four in number. Flow, 2400 gallons per hour.

Artesian Well, Illinois City, Rock Island County.

Carbureted Springs, Decatur, Union County.

Dixon Springs, Pope County; chalybeate.

Glen Flora Springs, Waukegan, Lake County.

Greenup or Cumberland Mineral Springs, Cumberland County. Greenup is a resort, and the water is used commercially.

Renna Wells Spring, Andalusia, Rock Island County.

Sailor Springs, Sailor Springs, Clay County. Two in number. Qualitative analysis shows sodium, potassium, calcium, magnesium, iron, silicic, sulphuric, carbonic, and phosphoric acids, and chlorine. Said to be useful in dyspepsia and kidney diseases; also used commercially.

Schuyler County Springs, Schuyler County; calcic-chalybeate.

Versailles Springs, Versailles, Brown County. Four in number; alkaline. Once a well-known resort; now said to be out of use.

The following springs are used commercially:

Apollo Springs, Dupage County.

Aurora Lithia Spring, Montgomery, Kane County.

Black Hawk Springs, Rock Island, Rock Island County.

Diamond Mineral Spring, Grant Fork, Madison County.

Red Avon Mineral Springs, Avon, Fulton County.

Sanicula Springs, Ottawa, La Salle County.

Tivoli Spring, Chester, Randolph County.

INDIANA.

Indiana extends from 37° 51′ to 41° 46′ north latitude and from 85° 48′ to 88° 1′ west longitude. It embraces an area of 33,809 square miles. The surface is generally level, except the eastern portion, which has an elevation of 700 to 900 feet. The principal rivers are the Ohio, which washes the southern part of the State; the Wabash, the Calumet, the White, the St. Joseph, and many smaller streams. The climate is salubrious, and is somewhat milder than is experienced in the same latitudes on the Atlantic coast. The winters are cold, but not of long duration, and the summers are often very hot. The mean annual temperature at Indianapolis is 51° F., and the annual rainfall is about 43 inches. The mortality-rate for the State, according to the United States census of 1890, was 11.03 per 1000 population, and the death-rate from phthisis 1.60 per 1000 of population.

Mineral springs are quite numerous in Indiana, although but few of them have achieved much reputation, and many have never been improved. Owing to the geological formation we find, as in the neighboring States, that iron and sulphur waters predominate. According to Peale's list, based chiefly on Prof. E. T. Cox's geological reports, the waters of twenty-seven springs have been subjected to a chemical analysis. It is believed, however, that but few of these are in use. Repeated letters as well as personal inquiries have failed to yield any information of several of the localities mentioned in the older works. We have, however, a much more detailed account of the Indiana Springs than has ever been published heretofore.

FRENCH LICK SPRINGS,

ORANGE COUNTY.

Post-office, French Lick Springs. Hotel at West Baden, one mile distant. This is one of the old spring resorts of Indiana. The springs are thirteen in number, of which several have been analyzed. The flow of water amounts to about 1100 gallons per minute. The following analyses are supplied by the United States Geological Reports, and were made by J. G. Rogers, analyst :

FRENCH LICK SPRINGS.

Saline-sulphureted.

One U. S. gallon contains: Solids.	Proserpine Spring. Grains.	Pluto's Well. Grains.
Sodium carbonate	10.52	. . .
Magnesium carbonate	4.50	1.59
Calcium carbonate	20.29	6.95

One U. S. gallon contains: Solids.	Proserpine Spring. Grains.	Pluto's Well. Grains.
Iron carbonate, Aluminium carbonate,	2.49	Trace.
Sodium sulphate	36.72	22.37
Magnesium sulphate	29.33	18.12
Calcium sulphate	141.00	60.59
Sodium chloride	90.92	140.54
Calcium chloride	. . .	5 35
Potassium chloride	5.01	. . .
Magnesium chloride	8.05	. . .
Silica	1.69	. . .
Alumina	. . .	Trace.
Undetermined matter	. . .	0.54
Total	350.52	256.05
Gases.	Cubic inches.	Cubic inches.
Carbonic acid	10.116	Not determined.
Sulphureted hydrogen	17.000	

These are very good examples of sulphated saline waters, and are useful in those diseases to which that class of water is applicable. They are used commercially at the present time.

GREEN CASTLE SPRINGS,

Putnam County.

Post-office, Green Castle. Hotels. Access *via* Indianapolis and St. Louis or Louisville, New Albany and Chicago R. R. direct to Green Castle.

This is another of the Indiana spring resorts mentioned in the older works. We have not been able to obtain any recent information in regard to it. The springs are three in number, and flow about 480 gallons of water per hour. They contain about 22 grains of solid matter per U. S. gallon, consisting chiefly of the carbonates of potash, soda, magnesia, iron, and lime, the chloride of sodium, and sulphates of magnesia and soda. They also contain about three cubic inches of carbonic anhydride to the gallon.

INDIAN SPRINGS,

Martin County.

Post-office, Indian Springs. Hotel for 500 guests. Access *via* Evansville and Richmond R. R., which passes the springs. Hacks meet all trains during the season. The resort is located eight miles north of Shoals, the county seat of Martin County.

The therapeutic value of the waters of these springs has been known for years, and they were in great repute among the aborigines. The springs were first opened to the public as a health resort in 1814, and they have maintained their reputation ever since. They have their source along the course of Sulphur Creek, which wends its way through the surrounding valley and empties into the Indian Creek, one mile distant from the hotel. The surrounding country is hilly and quite picturesque. The following analysis was made by Prof. E. T. Cox, State Geologist :

INDIAN SPRINGS.

Alkaline-saline. Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	3.65
Magnesium carbonate	18.95
Calcium carbonate	33.10
Potassium carbonate	2.40
Sodium sulphate	11.83
Potassium sulphate	2.40
Magnesium sulphate	30.40
Aluminium sulphate	0.82
Iron sulphate	20.23
Sodium chloride	39.38
Magnesium chloride	0.06
Bromides	Trace.
Iodides	"
Iron oxide	"
Silica	0.45
Total	163.67

Gases.	Cubic inches.
Carbonic acid	9.58
Sulphureted hydrogen	3.33
Oxygen	3.95
Nitrogen	6.45

This water is a powerful chalybeate, also a fairly strong alkaline-saline water.

INDIANA MINERAL SPRINGS AND MUD BATHS,

Warren County.

Post-office, Indiana Mineral Springs. Hotel. This new resort is located four miles from Attica, at the junction of the Wabash and the Chicago and Eastern Illinois R. R. Stages from the springs meet all trains.

Although but recently improved, this resort is rapidly coming into popular favor. A first-class hotel, with all modern improvements, has been constructed, and an elegant and commodious bath-house is ready for the requirements of visitors. The naturally picturesque location has already been much beautified by the landscape gardener and architect. The water of the springs is said to be pure and sparkling and pleasant to the palate. A recent qualitative analysis (May, 1893), under the direction of the manufacturing chemists, Messrs. Parke, Davis & Co., Detroit, showed the following ingredients: Total solid residue from one gallon, 20.21 grains, made up of the salts of magnesium, sodium, lithium, calcium, potassium, and silicon. The chemist also reports the presence of sulphuric and hydrochloric acids (probably in combination). There was no organic matter, and the water was highly carbonated. A special feature of the place is a deposit of inky-black mud surrounding the springs, and said to be strongly impregnated with the mineral ingredients of the water. This mud is warmed to the proper degree and applied by an attendant to the affected parts—the whole body, if required—in the form of a poultice. About one hour is required for the mud-bath, when the patient passes under a shower-bath and remains until all traces of the mud are removed. He is then placed in a porcelain-lined tub filled with lithia water for a soaking; then comes a refreshing rubbing by the attendant, and the bath for the day is ended. These baths are said to be exceedingly beneficial in cases of obstinate rheumatism, in hemiplegia, and in eczema and gout. The internal use of the water is indicated in renal and bladder affections.

KICKAPOO MAGNETIC SPRINGS,

WARREN COUNTY.

Post-office, Kickapoo. Private inn. These springs are located on the line of the Chicago and Eastern Illinois R. R., four miles northeast of Attica.

The scenery about the springs is delightful, and abounds in historic interest. They are situated in a valley, on either side of which mounds rise to the height of fifty or sixty feet. "Between the mounds run picturesque ravines, whose precipitous walls, composed in some places of soapstone, in others of gray or brown sandstone, show by their transverse marking the course of the ancient river as it flowed in torrents down the hillsides from the stranded and rapidly melting icebergs during the glacial period of our world's history." Among the objects of interest in the neighborhood may be mentioned Pine Creek, a romantic stream flowing through a deep valley, which is walled by towering cliffs of sand rock, crowned by evergreen pines, cedars, and junipers, combining scenery at once grand, wild, and beautiful. This creek was used as a strong line of defence by the confederated Indian tribes prior to the battle of Tippecanoe in 1811. A number of picturesque cascades, from thirty to one hundred feet in height, are to be seen in the immediate neighborhood. It is said that the principal spring was discovered by Kickapoo Indians as early as June, 1750. The water was analyzed in 1885 by H. A. Huston, of Purdue University, assistant State chemist, with the following result:

KICKAPOO MAGNETIC SPRINGS.

Light Alkaline-calcic.

One U. S. gallon contains :

Solids.	Grains.
Calcium carbonate	12.35
Magnesium carbonate	5.38
Ferrous carbonate	0.05
Silica	0.68
Sodium sulphate	0.99
Sodium carbonate	0.36
Organic and volatile matter	4.61
Total solids	24.42

The flow of water from this spring is about 1500 gallons per hour, having a temperature of 50° F.

The water is a very good antacid and diuretic. In large quantities it is said also to have a mild cathartic action. It is useful in flatulent dyspepsia with acid eructations, in irritability of the bladder, and prostatitis and in rheumatism. A peculiar black mud deposited near the springs is also used for bathing purposes.

LODI ARTESIAN WELL,

FOUNTAIN COUNTY.

Post-office, Lodi. This is a station on the Indianapolis and St. Louis R. R., fifty-eight miles west of Indianapolis.

The following analysis was made by Dr. J. C. Pohle :

LODI ARTESIAN WELL.

Saline-sulphureted.

One U. S. gallon contains :

Solids.	Grains.
Magnesium carbonate	0.66
Calcium carbonate	2.01
Sodium sulphate	2.13
Potassium sulphate	0.80
Magnesium sulphate	3.26
Calcium sulphate	55.56
Calcium phosphate	1.20
Sodium chloride	502.46
Calcium chloride	47.93
Magnesium chloride	53.54
Magnesium bromide	0,88
Silica	0.52
Sulphur	0.50
Nitrogenous organic matter	0.80
Total	672.45

This is a strong saline sulphureted water, and quite analogous to that of the Kentucky Blue Lick waters.

MAGNETIC MINERAL SPRING,

VIGO COUNTY.

Post-office, Terra Haute. This water is procured from an artesian well, 2000 feet deep, at the foot of Walnut Street, in the city of Terra Haute. The point is accessible by any street-car line in the city. A very elaborate natatorium and bath-house have been established. All kinds of hot, cold, vapor, swimming, or mud baths may be had under the direction of Dr. H. S. Tanner, of fasting fame. The water has been analyzed by Prof. W. A. Noyes, of the Rose Polytechnic Institute, with the following result :

MAGNETIC MINERAL SPRING.

Saline-calcic.

One U. S. gallon contains :

Solids.	Grains.
Silica	0.71
Alumina	0.17
Strontium chloride	Trace.
Calcium chloride	16.27
Calcium sulphide	2.07
Calcium sulphate	0.27
Calcium bicarbonate	21.94
Calcium phosphate	Trace.
Magnesium chloride	13.94
Magnesium bicarbonate	16.44
Lithium	More than a trace.
Potassium chloride	3.95
Sodium borate (borax)	More than a trace.
Sodium iodide	Trace.
Sodium bromide	More than a trace.
Sodium chloride	347.73
Hydrogen sulphide	5.87
Methane (marsh gas)	More than a trace.
Total	429.36

Temperature of water, 50° F.

The waters are mildly aperient, alterative, and tonic. They will be found useful in the disordered states usually benefited by this class of waters.

WEST BADEN SPRINGS,

ORANGE COUNTY.

Post-office, West Baden. Hotel. Access *via* Ohio and Mississippi R. R. to Shoals, thence by stage or *via* Louisville, New Albany and Chicago R. R. to Orleans, fifty-six miles north of New Albany, thence by stage to springs.

These springs are located in a fine agricultural section, only one mile from the French Lick Springs. The following analysis was made by E. T. Cox, analyst :

SPRING NO. 5 (WEST BADEN SPRINGS).

Alkaline-saline-chalybeate. Calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	9.69
Magnesium carbonate	6.05
Calcium carbonate	18.62
Iron carbonate, Aluminium carbonate,	3.00
Sodium sulphate	31.87
Magnesium sulphate	27.80
Calcium sulphate	108.39
Sodium chloride	81.12
Potassium chloride	6.13
Magnesium chloride	9.20
Total	301.87

Gases.	Cubic inches.
Carbonic acid	9.26
Sulphureted hydrogen	2.08
Oxygen	5.28
Nitrogen	15.97

The water is used commercially.

Among other springs of Indiana which have been more or less resorted to may be mentioned the following:

Cameron Springs, Warren County.
La Fayette Artesian Well, Tippecanoe County.
Millburn Springs, Pike County.
Mineral Spring, at New Middletown, Harrison County.
Trinity Springs, Martin County.
West Saratoga Springs, Pike County.

The following springs are also used commercially:

Greenwood Sanitarium Well, Greenwood, Johnson County.
King's Mineral Springs, Muddy Fork, Clark County.
Magnetic Mineral Well, Fort Wayne, Allen County.

Indiana also contains a number of undeveloped springs.

INDIAN TERRITORY.

This territory forms part of the vast inclined plane which slopes from the base of the Rocky Mountains to the Mississippi River. The Arkansas, Red, and Canadian Rivers drain the surface. The climate is warm and dry, the southeastern being the hottest and the northwestern the coldest portions; the mean annual temperature in the former being 60° and in the latter 55° F. The mean annual rainfall is 31.2 inches. We are unable to obtain reliable statistics relating to the mortality-rate of the Territory, and, as a large portion of the country is but little known, information concerning its mineral springs is also meagre. Several localities are described as resorts, but, as a rule, they are unimproved, and are used principally during the summer by persons who camp near them. The following list is derived from the United States Geological Reports.

MINERAL SPRINGS OF INDIAN TERRITORY.

Name and location.	Number of springs.	Flow in gallons per hour.	Temp. Fahr.	Character of water.	Remarks.
Court-house Spring, Cherokee Nation	...	...	...	Sulphureted	......
Harkin's Sulphur Springs, 20 miles east of Doaksville, Choctaw Nation	3	300	40°	Sulphureted, saline.	Resort
Kia-li-a-gee Springs, 15 miles east of We-tum-ka, Creek Nation	2	...	...	....	Reputation among the Indians
Oil Springs, on Oil Creek, south of Mill Creek, Chickasaw Nation	...	...	...	....	......
Eighteen miles northeast of Tahlequah, Cherokee Nation	...	...	...	Sulphureted, chalybeate	Resort in summer
Six miles north of Claremore Station, Cherokee Nation	...	...	...	....	......
Sulphur Springs, 50 miles south of Erin Springs, Chickasaw Nation.	...	...	...	....	Used in summer
At Tulsa, Creek Nation . . .	...	...	...	....	......
Seven miles from Claremore Station, Cherokee Nation	..	...	...	....	......

No previous work credits the Territory with any mineral springs. By dint of considerable correspondence with persons in various parts of the Territory we have secured the following account of the springs in two localities :

OIL SPRINGS,

Cherokee Nation.

Location, twenty-five miles from Siloam Springs, Ark., a station on the Kansas City, Pittsburg and Gulf R. R. This place is the country home of Mr. C. C. Whitmire, and his family constitutes the entire population. A hotel and several cottages were made ready for occupation in 1897. We are informed that numerous mineral springs are found in the neighborhood. Three of them lie close together, being only a few feet apart. They are called, respectively, the "Oil Petroleum," the "White Sulphur," and the "Black Sulphur" Springs. Within the radius of three-quarters of a mile are iron and numerous fresh-water springs. The location is about a mile and a half from the Illinois River and about 1000 feet above the sea-level. The surrounding country is mountainous and abounds with game. It is said that settlers have used the mineral waters with benefit for several years.

SECOR'S MINERAL SPRINGS,

CHOCTAW NATION.

Post-office, McAlester. These springs are located within two miles of the junction of the Missouri, Kansas and Texas and the Choctaw, Oklahoma and Gulf R. R., at a point one hundred miles north of Denison, Texas; one hundred and nine miles west of Fort Smith, Ark., and one hundred and ten miles east of Oklahoma City, Oklahoma Territory.

The springs are seven in number, but have never been analyzed nor improved for use. We are informed by Mr. William H. Secor, the proprietor, that some of them contain sulphur, iron, and saline ingredients, but that each one seems to be different from the others. They occupy a space of less than an acre in extent, and are located in a gently undulating section of the country, having a salubrious climate. The temperature ranges from 100° F. in summer to 10° F. in winter. The springs are reached by stage from South McAlester, two miles distant.

With the exception of Oil Springs, it is probable that none of the springs of the Territory have been improved up to the present time.

IOWA.

Iowa extends from 40° 25′ to 43° 30′ north latitude, and from 90° 18′ to 96° 53′ west longitude. It embraces an area of 55,045 square miles, and forms part of an immense plain unbroken by any mountain range. The Mississippi, which flows along the eastern border, and the Missouri, which washes the western shore, are the two great rivers of the State, all the other rivers being tributary to one or the other of these mighty streams. The climate is salubrious, and is not marked by unhealthy extremes, the mean annual temperature, as observed at Des Moines, being 48.94° F., the average summer temperature being 71.80° F. and the winter 25.39° F. The annual mortality-rate, according to the latest United States Census returns, is 9.16 per 1000 of population; phthisical mortality-rate, 0.96 per 1000.

The mineral springs of Iowa are not numerous. None is mentioned by any previous work on medicinal waters with the exception of Peale's list. The following account has been obtained by correspondence and personal inquiry.

BIG MINERAL SPRINGS AND FLOWING WELLS,

HAMILTON COUNTY.

Post-office, Webster City. Hotels in village. This resort consists of four artesian wells, located in Rosenkranz Park, within five minutes' walk of the post-office at Webster City—a place of 4000 inhabitants. The wells are situated on a sloping strip of ground within forty feet of Boone River. The park is beautifully shaded by a magnificent growth of forest trees. Improvements to the property are much needed. It is said that the location is an exceedingly desirable one for a first-class hotel. The mean temperature of the locality is 70° F. in summer and 20° F. in winter. The weather is generally clear, with showers in summer. The flow of water is about 40 gallons per minute, having a temperature of 32° F. The water contains iron, soda, magnesia, and sulphur, and is said to be beneficial in rheumatism, debility, nervousness, and in hepatic and renal disorders.

FRY'S MINERAL SPRING,

JASPER COUNTY.

Post-office, Colfax. Hotels: Fry's and five others. This is one of a group of ten well-known mineral springs located at Colfax, on the line of the Chicago, Rock Island and Pacific R. R. Like all the others of the group, this spring has an artesian flow and proceeds from a depth of between 300 and 400 feet.

Analysis by Dr. Heinrichs, Professor of Chemistry, Iowa State University:

FRY'S MINERAL SPRING.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	3.85
Sodium sulphate	78.86
Potassium sulphate	0.41
Magnesium sulphate	31.87
Calcium sulphate	13.07
Calcium carbonate	17.51
Iron carbonate	0.67
Silica alumina	0.29
Lithia	Trace.
Carbon dioxide	7.18
Total	153.71

Analysis by Prof. Haines, M.D., Chair of Chemistry and Toxicology, Rush Medical College, Chicago:

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	3.842
Sodium sulphate	77.344
Potassium sulphate	0.620
Calcium sulphate	31.750
Magnesium sulphate	10.230
Magnesium bicarbonate	25.939
Iron bicarbonate	0.258
Alumina	0.058
Silica	0.710
Organic matter	Trace.
Total	150.751

As seen by the analyses, the water is quite strongly impregnated with mineral ingredients, but not sufficiently so as to mar its pleasant taste. Ample bathing facilities are provided. The elevation of the location is 1100 feet above the sea-level, the surrounding country being of a hilly character. The waters of the spring have been found efficacious in rheumatism, dyspepsia, general debility, and in diseases of the blood, liver, kidneys, and nervous system.

LINEVILLE MINERAL SPRINGS,

Wayne County.

Post-office, Lineville. Springs Hotel. These springs are located two and one-half miles southwest of Lineville, a thriving town of 1000 inhabitants, on the southwestern branch of the Chicago, Rock Island and Pacific R. R. The Mineral Springs Hotel is a large, convenient, and commodious structure, picturesquely situated amid the hills bordering the Grand River. The scenery is diversified and interesting, and the atmospheric conditions of a salubrious and invigorating character. Everything has been done to render the house and surrounding grounds pleasant, comfortable, and homelike. The sanitary arrangements are excellent, and, with pure air and the presence of the Mineral Springs, with hot and cold water, the place offers many inducements to the seeker after health or recreation. The water is brought from a point 150 feet below the surface, by means of pipes, to the interior of the hotel. It is clear and sparkling, and very pleasing to the palate. The following analysis was made by Mr. A. E. Woodward, late assistant geologist of the State of Missouri:[1]

LINEVILLE MINERAL SPRINGS.

Saline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Silica	0.11
Alumina	0.28
Calcium sulphate	1.90

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[1] Geological Report of the Mineral Waters of Iowa, 1892, p. 127.

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	3.18
Sodium sulphate	180.30
Potassium sulphate	1.74
Sodium chloride	15.07
Total	202.58

This is a valuable purgative water. It is useful in dropsical affections due to renal disorders. It has also produced excellent results in cases of chronic constipation, functional disturbances of the liver, certain cutaneous diseases, and other affections.

SILOAM SPRINGS,

HARDIN COUNTY.

Post-office, Iowa Falls. Sanitarium accommodates about fifty guests. These springs are located within one mile of the city of Iowa Falls, which is accessible by three great lines of railroad, viz., the Chicago and Northwestern, the Illinois Central, and the Burlington, Cedar Rapids and Northern. The situation of the springs is on a beautiful, wooded hill, sloping southward and westward to a grassy meadow and the bluffs beyond, which border a stream of crystal water flowing all around the western and southern boundaries. The surrounding landscape is one of great beauty, containing hills, pretty streams, prairie and woodland views, pleasant lawns, and cultivated farms. The flow of water from the principal spring amounts to about four kerosene barrelsful per minute. Its temperature—48° F.—is about the same all the year. The following analysis was made by Prof. Gustavus Bode, of Milwaukee:

SILOAM SPRINGS.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.07
Sodium sulphate	0.43
Sodium bicarbonate	2.50
Calcium bicarbonate	18.11
Magnesium bicarbonate	10.22
Iron protoxide bicarbonate	0.07
Alumina	0.12
Silica	0.83
Organic matter	Trace.
Total	32.35

The water is clear and very pleasant to the taste. The analysis shows a strong resemblance to that of the "Bethesda" water of the Waukesha Springs. It has been found beneficial in the treatment of neurasthenia, torpidity of the liver, indigestion, and in renal and other disorders. The sanitarium contains ample facilities for bathing, being supplied with a sudatorium (hot room), Turkish bath, etc.

STORM LAKE MINERAL SPRING,

BUENA VISTA COUNTY.

Post-office, Storm Lake. Good hotel accommodations. This spring is located one mile from the village of Storm Lake, at a level of 900 feet above the Mississippi River. The surrounding country is level, and not especially interesting. The temperature ranges from about 70° F. in summer (average) to zero in winter. The following analysis is by Walter L. Brown, analytical chemist, of Chicago:

STORM LAKE MINERAL SPRING.

Alkaline-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.18
Potassium sulphate	3.02
Sodium sulphate	3.22
Calcium sulphate	35.12
Magnesium sulphate	3 40
Magnesium bicarbonate	10.78
Silica	3.56
Iron oxide and alumina	0.18
Organic matter	Trace.
Total	59.46

There is also present a large amount of free carbonic acid gas.

The waters are said to be efficacious in diseases of the liver, bowels, and kidneys.

WHITE SULPHUR SPRINGS,

SCOTT COUNTY.

Post-office, White Sulphur. Hotel destroyed by fire in 1893. The waters of these springs are now used commercially. The following analysis was made by Emory Rush, of Buffalo, N. Y.:

IOWA WHITE SULPHUR SPRINGS.

Alkaline-saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	92.79
Calcium chloride	33.56
Magnesium chloride	23.26
Carbonic acid	31.57
Sodium bicarbonate	40.57
Iron bicarbonate	27.37
Potassium sulphate	6.13
Sodium phosphate	5.00
Silica	30.56
Magnesium sulphate	16.23
Total solids upon evaporation	307.04[1]

Temperature, 56° F.

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[1] Total solids are made to foot up 296.44 by analyst.

Among other mineral springs of Iowa may be mentioned the following:

The Cherokee Magnetic Mineral Springs, Cherokee County.
Dunbar's Mineral Spring, Page County.
The Iowa Acid Spring, Wapello County.
The Linwood Spring, flowing 30,000 gallons per hour, Scott County.
Ottumwa Medical Springs, Wapello County.
Sulphur Springs, Buena Vista County.

KANSAS.

Kansas lies within the meridians of 94° 37′ and 102° west longitude, and the parallels of 37° and 40° north latitude. It is the Central State of the Union, being equidistant from the Pacific and Atlantic Oceans, on the west and east, and the British possessions and Mexico on the north and south. The surface is generally undulating, with a gentle slope toward the east. The extreme elevation is on the western border, 3800 feet, while at the mouth of the Kansas River it is less than 750 feet above the sea-level. There are no mountains, but the scenery is redeemed from monotony by the rich, grass-covered hills and the fertile river valleys, while the Arkansas and Republican Rivers are bordered by bold bluffs from 200 to 300 feet in height. The principal rivers are the Missouri, which washes the northeastern boundary; the Kansas, which with its affluents, the Smoky Hill, Delaware, Blue, Republican, Solomon, and Saline Rivers, drains the northern portion of the State and empties into the Missouri; the Arkansas, which drains all Southern Kansas, and the Osage, which flows through the eastern and central portion of the State. The climate is mild and healthful, the mean annual temperature, as observed at Lawrence, being about 53° F., that of the summer 75.82° F., and of the winter 31.65° F. The average rainfall is about 31.75 inches. The death-rate per 1000 of population in 1890 was 8.42; mortality-rate from consumption, 0.96 per 1000.

The mineral springs of Kansas have not hitherto attracted much attention. None are mentioned by Walton in the latest edition (1892) of his book on *Mineral Springs*, and in the 1898 issue of Polk's *Medical Register of the United States* it is stated that none exist. We find, however, that the State possesses a number of mineral springs, some of them having considerable local reputation, but none of them being well known outside of the State. The following account is derived from Peale's list, from the report of the Kansas State Board of Agriculture for 1885 (Prof. E. H. S. Bailey), from a personal visit to the State, and from correspondence with various persons. It will be observed that the waters are mainly alkaline-saline or alkaline-saline-sulphureted.

ARRINGTON MINERAL SPRINGS,

ATCHISON COUNTY.

Post-office, Arrington. Hotel. Access *via* Union Pacific R. R. These springs are located on a tract of land, eighteen acres in extent, in a level, highly fertile farming country. The Delaware River passes through the property, which abounds in groves of fine timber trees. The springs are three in number, and flow about 8 gallons per minute. The temperature of the water is 56° F. Messrs. D. S. Heneks & Son, of the Missouri Valley Rolling Mills, furnish the following analysis of two of the springs, made by Juan H. Wright, M.D., chemist, of St. Louis, Mo.:

ARRINGTON MINERAL SPRINGS.

Alkaline-chalybeate. Carbonated.

Spring No. 1 (Reaction decidedly alkaline).

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	9.76
Magnesium carbonate	5.93
Sodium carbonate	11.45
Potassium carbonate	1.44
Iron carbonate	3.57
Lithium carbonate	0.47
Sodium sulphate	2.04
Calcium sulphate	1.29
Magnesium sulphate	1.87
Sodium chloride	3.63
Silica	0.97
Ammonium crenate	0.89
Organic matter	0.27
Total	43 58

Carbonic acid gas, 42 cubic inches per U. S. gallon.

Spring No. 2 (Alkaline-chalybeate; reaction alkaline).

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	6.61
Magnesium carbonate	3.26
Sodium carbonate	3.55
Iron carbonate	2.01
Sodium chloride	2.16
Silica (soluble)	0.55
Organic matter	0.91
Ammonia	Trace.
Total	19.05

Carbonic acid gas, 39.30 cubic inches per U. S. gallon.

The waters are highly esteemed in dyspepsia, general debility, rheumatism, hemorrhoids, constipation, and liver and kidney complaints. Commodious bath-rooms, supplying hot and cold water, are open to visitors.

GEUDA SPRINGS,

COWLEY COUNTY.

Post-office, Geuda Springs. Hotel and boarding-houses. The Geuda Mineral Springs are located on the St. Louis and San Francisco R. R., one mile distant from the Arkansas River and eight miles north of Indian Territory. The town of Geuda Springs, which has about 800 inhabitants and is rapidly growing, is pleasantly situated at the edge of a beautiful and undulating plateau, which is everywhere dotted with fine farms and neat farm-houses. The elevation above the sea is about 1400 feet, and the atmosphere is pure and wholesome. The winters are short and open, making constant outdoor exercise possible. There are a few very hot days in the summer, the thermometer at rare intervals extending above 100° F., but, as a rule, the days are balmy and the nights cool and refreshing. The springs are seven in number, and bubble up in a space less than twenty feet square. Near the springs is a beautiful lake of salt water, with an area extending to the westward nearly two miles, and another to the southward half that distance. The evaporation of the water causes the beach to be covered with pure, crystallizable salt. This picturesque body of salt water, constantly fed by salt springs, furnishes fine advantages for bathing. The lake bottom is hard and sandy, and bathers can secure any depth of water desired. A commodious bath-house in connection with the springs affords opportunities for any variety of bath which may be desired. Following is a detailed analysis of the seven springs by Prof. Bailey, of the Kansas State University:

GEUDA SPRINGS.

Sulphated-saline. Carbonated.

Number of grains in each U. S. gallon of 231 cubic inches.	Spring No. 1.	Spring No. 2.	Spring No. 3.	Spring No. 4.	Spring No. 5.	Spring No. 6.	Spring No. 7.
Sodium chloride	1030.93	1056.28	815.68	671.76	357.05	432.20	504.21
Calcium sulphate	199.64	204.73	167.58	158.29	145.88	147.33	160.17
Magnesium sulphate	25.56	24.24	28.53	26.64	24.98	27.43	22.86
Magnesium chloride	16.55	19.96	10.01	7.90	8.45	4 95	9.66
Calcium bicarbonate	3.70	5.90	5.99	6.86	10.67	12.50	5.51
Potassium sulphate	2.12	1.69	1.90	1.90	0.82	0.54	0.47
Sodium phosphate	0.02	0.02	0.02	0.02	0.04	0.08	0.08
Sodium bromide	0.02	0.02	0.01	trace	……	……	……
Sodium iodide	trace	……	trace	……	……	……	……
Sodium biborate	0.16	0.16	0.16	0.08	0.12	0.12	0.25
Sodium nitrite	0.38	0.40	0.18	……	0.02	0.03	0.03
Sodium bicarbonate	0.41	0.32	0.39	0.69	0.49	0.31	0.60
Sodium sulphide	……	……	……	……	……	0.65	……
Lithium chloride	trace	trace	trace	trace	trace	trace	trace
Iron bicarbonate	0.07	0.19	0.07	0.05	0.03	0.06	0.08
Alumina	0.06	0 01	……	0.01	0.01	……	0.01
Silica	0.67	0.86	0.81	0.79	0.92	0.73	0.79
Organic matter	trace	trace	trace	trace	trace	trace	trace
Total	1280.29	1314.78	1031.14	874 99	549.48	626.92	704.73
Free carbonic acid gas in cub. in.	34.96	27.69	18.32	17.64	23.98	22.16	29.05
Sulphureted hydrogen gas	……	……	……	……	……	trace	trace
Specific gravity	1.018	1.016	1.013	1.012	1.008	1.009	1.009
Temperature	63° F.	63° F.	63° F.	63° F.	63° F.	63° F.	63° F.

The waters have found their most suitable application in liver, kidney, and stomach disorders, general debility, anæmia, and rheumatism. Some of the springs have gained considerable celebrity in the local treatment of conjunctivitis, indolent ulcers, leucorrhœa, etc.

LOUISVILLE MINERAL SPRINGS,

POTTAWATOMIE COUNTY.

Post-office, Louisville. Accommodations in two hotels and in private families. Access *via* Union Pacific R. R. to Wamego, thence three miles to spring by stage.

This resort has attracted much attention in Kansas recently. The springs are charmingly located in a natural blue-grass park of ten acres, which has been greatly improved. It is said to be one of the finest camping places in Kansas. The surrounding country is hilly and the location of the springs about 900 feet above the sea-level. The temperature ranges from 10° F. in winter to 100° F. in summer, these figures representing the extremes. The springs are two in number, and afford an abundance of pure, crystal water, having a temperature of 60° F. A qualitative analysis made in 1885 showed the presence of iron, sulphur, soda, magnesia, and carbonic-acid gas. The waters have been found of great efficacy in constipation, dyspepsia, general debility, and liver and kidney affections.

MANHATTAN ARTESIAN WELLS,

RILEY COUNTY.

Post-office, Manhattan. Hotel. These wells are located in a hilly country, eleven miles southeast of the town of Manhattan, and at an elevation of about 800 feet above the sea-level. The wells are two in number, and discharge about 24,000 gallons of water daily. This is of the sulphated-saline variety, and has a uniform temperature of 55° F., summer and winter. The following analyses were made by Prof. Failyer, of the Kansas Agricultural College :

MANHATTAN ARTESIAN WELLS.

Sulphated-saline. Acid.

Well No. 1 (Mineral Water).

One U. S. gallon contains :

Solids.	Grains.
Calcium oxide (as bicarbonate)	5.27
Calcium oxide (as sulphate and chloride)	33.36
Magnesium oxide (as sulphate)	5.65
Iron oxide (bicarbonate)	0.18
Sodium (as chloride)	0.51
Potassium	Trace.
Sulphuric acid (anhydrous)	61.36
Chlorine	1.46
Bromine	Trace.
Silica	10.09
Lithium	Trace.
Total	117.88

Well No. 2.

One U. S. gallon contains:

Solids.	Grains.
Calcium oxide (as bicarbonate)	6.07
Calcium oxide (as sulphate)	14.69
Magnesium (as sulphate)	6.58
Iron (as bicarbonate)	0.24
Sodium (as chloride)	0.86
Potassium	Trace.
Sulphuric acid (anhydrous)	33.11
Chlorine	1.79
Silica	10.18[1]
Total	73.52

The waters have been in use since 1884, and have been found beneficial in rheumatism, malaria, renal disorders, constipation, general debility, and diabetes. The waters themselves, as well as the salt remaining after evaporation, are used commercially.

MOODYVILLE MINERAL SPRINGS,

POTTAWATOMIE COUNTY.

Post-office, Moodyville. Hotel. Access *via* Kansas Central R. R. to Blaine, thence four miles southeast to springs.

These springs are three in number, and flow about 25 gallons per minute. According to an analysis by Prof. J. R. Eaton, of William-Jewel College, Missouri, the waters contain the following ingredients :

Free carbonic acid gas.
Calcium carbonate.
Magnesium carbonate.
Magnesium sulphate.
Sodium sulphate.
Sodium chloride.
Iron (probably as carbonate), a trace.
Silica, alumina, and organic matter, a small amount each.

The water is used in dyspepsia and disorders of the bowels, liver, and kidneys.

TOPEKA MINERAL WELLS,

SHAWNEE COUNTY.

Post-office, Topeka. Hotel. These wells, two in number, are located on Harrison Street, in the city of Topeka. We are informed that a good hotel has been established at the wells for the accommodation of persons requiring treatment. Turkish, Russian, electric, and steam baths may be obtained. The following analysis of the water was made by Messrs. Barnes & Sim, chemists. The estimate was presumably made in grains per United States gallon :

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[1] According to U. S. Geological Reports Well No. 2 contains 1.19 grs. of silica per U. S. gallon.

TOPEKA MINERAL WELLS.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Magnesium chloride	11.76
Sodium sulphate	19.20
Magnesium sulphate	14.36
Sodium nitrate	1.94
Sodium bicarbonate	35.61
Calcium bicarbonate	22.48
Iron bicarbonate	28.06
Ammonium sulphate	1.50
Alumina	0.40
Silica	10.28
Organic matter	1.76
Phosphoric acid	Trace.
Total	147.35

The baths have been in operation since 1879. They are highly recommended for obstinate cases of rheumatism. The water is also used commercially. The analysis shows a fairly strong saline-purgative water, and it should be useful in cases to which such waters are applicable.

WACONDA SPRING,

MITCHELL COUNTY.

Post-office, Cawker City. Hotel and sanitarium. Access: Trains on the Central Branch of the Missouri Pacific R. R. stop within a few rods of the hotel.

This big spring is located within a fine curve of the Solomon River, about three miles from Cawker City, and at an elevation of about 3500 feet above the level of the sea. The spring is contained in the centre of a huge, circular mound composed of hard rock, which rises to a height of thirty feet above the surrounding surface. The spring is sixty feet in diameter, and is surrounded by a natural platform of rock from eighty to one hundred and fifty feet wide, and so nearly circular as to appear as if artificially cut. The diameter of the base of the mound is 117 yards from north to south and 119 yards from east to west, while its circumference is sixty-six rods. A stone coping has been placed around the spring, and this is surmounted by a light iron fence, to protect the water. Within ten rods of the spring a substantial hotel and sanitarium, supplied with all modern comforts and conveniences, has recently been erected. The water from the spring is supplied to this building, and is utilized for the bath-houses, where all varieties of hot and cold or vapor baths will be found. The surroundings of this resort are very attractive, and the climate is of a bracing and salubrious character. The following analysis of the water was made by Prof. G. E. Patrick, of the University of Kansas, at Lawrence:

WACONDA (OR GREAT SPIRIT) MINERAL SPRING.

Alkaline-saline. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	765.76
Sodium bromide	0.23
Sodium sulphate	183.60
Magnesium sulphate	85.28
Sodium bicarbonate	26.92
Magnesium bicarbonate	27.56
Calcium bicarbonate	31.30
Silicic acid	Trace.
Nitrous acid	"
Organic matter	None.
Total	1120.65

Carbonic acid gas, 91 cubic inches to the gallon.
Specific gravity, 1017.

The water has a strong saline taste, and when properly carbonated is clear and sparkling. The analysis shows a water of great potency. It should be fully possessed of the qualities found in the waters of this class. Taken in proper doses it is said to stimulate the appetite, tone up the nervous system, and to invigorate the spirits and general bodily condition to a remarkable degree. It may be safely recommended in all cases in which this class of waters has been found useful. It is bottled and shipped to any desired point.

The following mineral spring resorts in Kansas have been reported by the United States Geological Survey, but we have not found it possible to gain any further account of them:

Baxter Medical Springs, Cherokee County.
Bonner's Springs (twenty in number), Wyandotte County.
Girard Mineral Well, Allen County.
Iola Mineral Well, Allen County.
Jewell County Lithium Spring, Montrose, Jewell County.
Mineral Spring, Atchison County.
Tar Spring, Miami County.

It is probable that other springs in the State will be developed and become resorts in the near future.

KENTUCKY.

Kentucky extends from 36° 30′ to 39° 0.06′ north latitude, and from 82° 0.06′ to 89° 44′ west longitude. It has a river boundary of 813 miles, its northern border being washed by the Ohio, its eastern by the Big Sandy or Chattaroi, and its western by the

Mississippi. Nearly all the other rivers which drain the State are affluents of the Ohio. The only mountains in the State are the Cumberland Range, which separates it from Virginia. The eastern counties are rendered broken and rugged by this range. The banks of the rivers are natural curiosities in some places, having worn very deep channels in the rocks over which they flow. The precipices formed by the Kentucky River in many places present banks of 300 feet of solid limestone. The climate here, as in all parts of the United States, is variable; but Kentucky is marked by no unhealthy extremes, the mean annual temperature being 55° F., that of the summer 73.96° F., and of the winter 38° F. The average annual rainfall along the Ohio River is about 48 inches, and in the southern extremity 60 inches. The mortality-rate in Kentucky, according to the latest United States Census returns, was 12.85 per 1000 of population; phthisical death-rate 1.90 per 1000 of population.

Kentucky has hitherto occupied a prominent position as a mineral spring State. Walton describes eleven localities which have been used as resorts, while the reports of the United States Geological Survey mention no less than twenty-three, besides several springs which are used commercially. Some of the springs, notably the Crab Orchard and the Blue Lick, have acquired a national celebrity, and their waters have been extensively sold throughout the Union. There can be no doubt that at this time the springs of Kentucky are not enjoying the high measure of popular esteem which they once possessed. Few of the waters are found in the market, and several localities have been abandoned. The once famous Harrodsburg Springs, for example, which are still described as being a health-resort in the most recent work on this subject (Walton, 1883), were abandoned thirty-five years ago, the buildings having been destroyed by fire and never rebuilt.[1] There are two great water-beds in Kentucky, viz., the calciferous sandstone, underlying the silurian rocks, and the great sandstone formation at the base of the coal measures, and artesian mineral wells may be found by boring from 150 to 300 feet in any localities coming within range of these formations. The following account of the Kentucky springs is based chiefly on the reports of the State and United States Geological Surveys, and on Walton's work, verified to some extent by a personal visit to the State and by correspondence with physicians and others living in the localities.

BEDFORD SPRINGS,

TRIMBLE COUNTY.

Post-office, Bedford Springs. Hotel and cottages. Access *via* Louisville and Cincinnati Shortline R. R. to Sulphur Station, thirty-six miles east of Louisville and seventy-one miles west of Cincinnati, thence six miles by pike road to springs.

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[1] Letter from postmaster to editor, 1897.

These springs are located on a high ridge between the Ohio and Little Kentucky Rivers. They are three in number, and yield about three gallons of water per minute. The weather in this vicinity is usually clear and bright, the average temperature-range being about 75° F. in summer and 30° F. in winter. The following qualitative analysis was made by J. P. Barnum, analytical chemist:

Sodium chloride.
Magnesium bicarbonate.
Calcium bicarbonate.
Sodium sulphate.
Lithium carbonate.
Sodium carbonate.

Reaction—alkaline to test-paper.

The water is recommended for diseases of the stomach, kidneys, and liver, and in gout and rheumatism. They are sold in Louisville by the gallon or barrel.

BIG BONE SPRINGS,

Boone County.

Access *via* Louisville and Nashville R. R. to Walton; thence seven miles by stage to springs, or by steamer on the Ohio River to Hamilton Landing, thence one and one-half miles to springs.

These springs are of the saline-sulphureted variety. No qualitative analysis has been made. It is stated, however, that the waters contain the following ingredients:[1]

Sodium chloride.
Magnesium sulphate.
Sodium sulphate.
Aluminium sulphate.
Calcium bicarbonate.
Magnesium bicarbonate.
Sodium carbonate.

There is also a large quantity of sulphureted hydrogen gas.

BUENA VISTA SPRINGS,

Logan County.

Post-office, Russellville. Springs Hotel. Accessible *via* Louisville and Nashville R. R. (Memphis Branch) and Owensboro and Nashville Branch to Russellville, thence by stage six miles to springs. The stage meets morning trains leaving Russellville for springs at 8 A.M.

This resort is located in a beautiful and picturesque region, interspersed with lofty hills, deep gorges, beautiful dells, and majestic native forests. The hotel has been rebuilt, and the guest will now find a large and commodious building, which will meet all the requirements of modern cultivated tastes. In front of the house is a large lawn, decorated with a variety of native trees and ornamental shrubbery; midway of the lawn a stream of crystal water wends its way—Elk Lick Creek—taking its name from the springs, which were formerly called Elk Lick from the fact that it was a great resort for elk, deer, and other wild animals. The springs—two in number—are situated in the lawn, where they rise from their subterranean recesses, and, flowing forty feet, empty into the creek. The following qualitative analysis of Spring No. 1 was made by Dr. L. P. Yandell, Professor of Chemistry and Physiology in the University of Louisville:

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[1] Geology of Kentucky, vol. ii. p. 62.

Solids.
Magnesium sulphate.
Calcium sulphate.
Calcium carbonate.

Solids.
Magnesium carbonate.
Sulphureted hydrogen gas (abundant).
Carbonic acid gas.

Dr. H. A. Utley's analysis of Spring No. 2:

Solids.
Magnesium sulphate.
Magnesium carbonate.
Magnesium phosphate.
Potassium carbonate.
Potassium phosphate.
Sodium carbonate.

Solids.
Sodium phosphate.
Iron phosphate, } Traces.
Iron chloride, } Traces.
Calcium carbonate, } Traces.
Free carbonic acid gas.

The waters have been highly recommended by Kentucky physicians in liver disorders, malarial affections, rheumatism, skin diseases, anæmia, general debility, and other conditions. Various amusements, in the way of a tennis court, croquet grounds, billiard table, swings, and walks over the hills and through the gorges are at the option of the visitor.

CLEAR CREEK SPRINGS,

Bell County.

Post-office, Pineville. Small hotel. Access *via* Cumberland River and Tennessee R. R., which connects with the Louisville and Nashville R. R. at Pineville, a distance of three miles from the springs.

The location of the springs is in the Clear Creek valley, almost entirely surrounded by mountains. The elevation is about 1300 feet above the sea-level. This region possesses many advantages in the way of charming scenery, exhilarating mountain air, etc. The springs in use are two in number, possessing about the same general chacteristics. The following analysis was made by Robert Peter, State Geologist of Kentucky, in 1883:

CLEAR CREEK SPRINGS.

Light Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.[1]
Calcium carbonate	2.07
Magnesium carbonate	Traces.
Calcium sulphate	0.33

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[1] Converted from parts per 1000.

One U. S. gallon contains: Solids.	Grains.
Magnesium sulphate	1.43
Calcium chloride	0.16
Sodium carbonate	1.84
Silica	0.51
Alumina	Traces.
Total	6 34

The water is said to be remarkably pure and well adapted to the uses of the table. We are informed that it has long enjoyed a considerable reputation in dyspepsia, liver and kidney affections, skin diseases and disorders of the female pelvic organs.

CRAB-ORCHARD SPRINGS,

LINCOLN COUNTY.

Access *via* Knoxville Branch of the Louisville and Nashville R. R to Crab Orchard, one hundred and fifteen miles southeast of Louisville. These waters are chiefly used in the manufacture of the famous Crab Orchard salts, which are used extensively in Kentucky and neighboring States as a cathartic. The following analyses were made by Dr. Robert Peter, State Geologist:

CRAB ORCHARD WATERS.

Sulphated-saline.

One U. S. gallon[1] contains: Solids.	Epsom or Foley's Spring. Grains.	Sowder's Spring. Grains.
Magnesium carbonate	7.64	19.20
Iron carbonate	Trace.	Trace.
Calcium carbonate	53.18	29.51
Sodium chloride	17.72	58.32
Potassium sulphate	9.91	17.37
Sodium sulphate	59.07	23.20
Magnesium sulphate	205.28	174.31
Calcium sulphate	10.79	91.32
Bromine	. . .	Trace.
Silica	3.26	1.22
Loss and moisture	34.58	Trace.
Total	401.43	414.45

Carbonic acid, not estimated.

CRAB ORCHARD SALTS.

100 parts contain:	Parts.
Magnesium sulphate	63.19
Sodium sulphate	4.20
Potassium sulphate	1.80
Calcium sulphate	2.54
Sodium chloride	4.77
Lime, magnesia, iron, and silica (carbonates)	0.89
Bromine	Trace.
Water of crystallization and loss	22.61
Total	100.00

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[1] Converted from grains per pint.

Other springs at Crab Orchard are the "Field" and the "Grove" springs, which are but feebly impregnated with mineral ingredients.

DRENNON SPRING,

HENRY COUNTY.

Access *via* New Castle, thence ten miles northward to spring.

This is an old-time spring resort which has been allowed to languish. About thirty years ago a cholera epidemic appeared during a prosperous season, and the guests fled in dismay. During the following year a fire destroyed the buildings, and they have never been rebuilt. No analysis has ever been made, but the waters are said to be of the saline-sulphur variety. According to the report of the Kentucky Geological Survey, they possess mild aperient, diuretic, and diaphoretic properties.

ESCULAPIA SPRINGS,

LEWIS COUNTY.

Post-office, Esculapia Springs. The location is about twenty miles from Maysville and twelve miles from Vanceburg, on the Ohio River. The springs are three in number, and the water has a temperature of 55° F. As far as we can learn no complete quantitative analysis has been made. An old qualitative analysis by Dr. Peter, State Geologist, showed the presence of the bicarbonates of lime and magnesium, chlorides of sodium and magnesium, and sulphates of sodium and magnesium, besides free sulphureted hydrogen gas. The water possesses mild diaphoretic and diuretic properties.

ESTILL SPRINGS,

ESTILL COUNTY.

These springs are located forty miles west of Irvine. We are indebted to the United States Geological Reports for the following analysis, made by Dr. Robert Peter:

ESTILL SPRINGS.

One U. S. gallon[1] contains: Solids.	Red Sulphur Spring[2] (near saloon). Grains.	Chalybeate Spring.[3] Grains.
Sodium carbonate	1.16	. . .
Calcium carbonate	11.66	9.32
Magnesium carbonate	4.64	2.93
Iron carbonate	. . .	1.75
Sodium sulphate	9.91	0.58
Potassium sulphate	5.24	0.58
Calcium sulphate	. . .	16.32
Magnesium sulphate	0.58	9.91
Sodium chloride	5.24	0.58
Alumina	. . .	Trace.
Silica	0.58	1.75
Organic matter	2.33	8.16
Total solids	41.34	51.88

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[1] Converted from parts per 1000.

[2] Light alkaline-carbonated. Sulphureted.

[3] Alkaline-calcic. Chalybeate.

Gases.	Cubic inches.	Cubic inches.
Sulphureted hydrogen	0.26	. . .
Carbonic acid	18.98	15.68

The waters are principally of the light sulphureted type, with one mild ferruginous spring. Another spring in the neighborhood, termed by Walton the "Irvine" Spring, is purgative, containing about 256 grains of sulphate of magnesium to the gallon. As far as we are able to learn, the place is not at present improved as a resort.

FOX SPRINGS,

Fleming County.

Fox Springs are located ten miles from Flemingsburg. The springs are of the sulphureted variety, and are six in number. The waters are mildly diuretic, and are also said to promote the secretions of the skin.

GRAYSON SPRINGS,

Grayson County.

Post-office, Grayson Springs. Spring Hotel. Access from Elizabethtown and Paducah R. R., twenty-six miles west to Grayson Springs Station, thence two and one-half miles by stage to springs.

There are more than one hundred springs in this vicinity, flowing upward of 2800 gallons per hour. The waters are chiefly of the sulphureted type, and have a temperature ranging from 58° to 67° F. Following are analyses of two of the representative springs by Dr. Peter :

GRAYSON SPRINGS.

One U. S. gallon contains: Solids.	McAntee Spring.[1] Grains.	Eye Spring.[2] Grains.
Calcium carbonate	10.49	11.07
Magnesium carbonate	Trace.	Trace.
Manganese carbonate, Iron carbonate,	0.58	0.58
Sodium sulphate	1.16	1.16
Potassium sulphate	Trace.	Trace.
Calcium sulphate	26.23	39.06
Magnesium sulphate	26.81	43.72
Manganese sulphate, Iron sulphate,	1.16	Trace.
Sodium chloride	1.16	6.41
Sodium sulphide	. . .	0.58
Silica	Trace.	0.58
Lithium, Iodine, Bromide,	Trace.	. . .
Organic matter	Trace.	1.75
Total	67.59	104.91

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[1] Sulphated-saline. Sulphureted.

[2] Sulphated-saline.

Gases.	Cubic inches.	Cubic inches.
Sulphureted hydrogen	11.83	1.39
Carbonic acid	8.74	. . .

HARRODSBURG SPRINGS,

MERCER COUNTY.

As before stated, these springs have long since ceased to be a health resort. Their waters, however, are valuable as saline purgatives, as shown by the following analysis, which we derive from Walton's work :

HARRODSBURG SPRINGS.

One U. S. gallon contains: Solids.	Grenville Spring.[1] Grains.	Saloon Spring.[2] Grains.
Magnesium carbonate	22.96	2.08
Iron carbonate	. . .	2.88
Calcium carbonate	4.80	23.92
Sodium chloride	Trace.	39.92
Magnesium sulphate	129.28	223.36
Calcium sulphate	88.48	81.92
Total	245.52	344.08

There are several other springs in the neighborhood. According to Dr. Drake, these waters are very beneficial in chronic inflammations and obstructions of the abdominal viscera; in such cases of dyspepsia as are attended by subacute gastritis, and in many hepatic disorders. They have been found almost equally beneficial in chronic inflammations of many other parts of the system, especially of the serous and fibrous membranes.

LATONIA SPRINGS,

KENTON COUNTY.

Location, four miles south of Covington (opposite Cincinnati).

These springs are five in number, and are feebly sulphureted. No complete analysis has been made.

LOUISVILLE ARTESIAN WELL,

JEFFERSON COUNTY.

Location, on the corner of Tenth and Rowan Streets, Louisville. This well is 2086 feet deep by three and one-half feet in diameter, and occupied sixteen months in boring. As it issues from the orifice of the well the temperature of the water is 76.5° F. A self-registering thermometer sunk to the bottom of the well indicated 86½° F. The point of constant temperature immediately beneath the surface at Louisville is 53° F., this result shows an increase of temperature of one degree for every sixty-seven feet until the bottom is reached. The following analysis is by Dr. J. Lawrence Smith:

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[1] Sulphated-saline.

[2] Sulphated saline. Chalybeate.

LOUISVILLE ARTESIAN WELL.

Sulphated and Muriated. Saline-sulphureted. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	621.52
Calcium chloride	65.72
Magnesium chloride	14.77
Potassium chloride	4.22
Aluminium chloride	1.21
Lithium chloride	0.10
Sodium sulphate	72.29
Calcium sulphate	29.43
Magnesium sulphate	77.33
Aluminium sulphate	1.80
Potassium sulphate	3.22
Sodium bicarbonate	2.72
Calcium bicarbonate	5.99
Magnesium bicarbonate	2.75
Iron bicarbonate	0.35
Sodium phosphate	1.54
Magnesium iodide	0.35
Magnesium bromide	0.46
Silica	0.88
Organic matter	0.70
Loss in analysis	8.12
Total	915.47

Gases.	Cubic inches.
Sulphureted hydrogen	2.0
Carbonic acid	6.17
Nitrogen	1.36

The water is quite similar to that of the Kissingen Springs, in Bavaria, and to the Kentucky Blue Lick Springs. It has been found very beneficial in cases of dyspepsia and constipation and in functional liver complaints.

LOWER BLUE LICK SPRINGS,

NICHOLAS COUNTY.

Access *via* Kentucky Central R. R. to Carlisle, thence nine miles by stage to springs. We have not been able to obtain any recent information of the condition of this resort. The following analysis of the main spring was made by Dr. Robert Peter, the State Geologist, a number of years ago:

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	1.36
Calcium carbonate	23.65
Potassium chloride	1.39
Sodium chloride	512.85

One U. S. gallon contains:

Solids.	Grains.
Magnesium chloride	32.39
Potassium sulphate	8.93
Calcium sulphate	33.99
Magnesium iodide	0.05
Magnesium bromide	0.24
Alumina, lime, phosphate, iron oxide	0.36
Silicic acid	1.10
Loss	17.72
Total	634.03
Gases.	**Cubic inches.**
Carbonic acid gas	98.80
Sulphureted hydrogen	18.24

"These are exceptionally fine waters of the saline-sulphureted class, valuable in engorgements of the liver and abdominal viscera and diseases arising therefrom. They may be relied on in gastric catarrh, and in the form of warm baths prove efficacious in diseases of the skin." (Walton.)

Besides the main spring there are others on the opposite side of the Licking River and in its bed which have been found on examination to be of a similar character.

OLYMPIAN SPRINGS,

BATH COUNTY.

Post-office, Olympian Springs. Access *via* Lexington and Big Sandy R. R. to Mount Sterling, thence by stage.

These springs are ten in number, and are of the saline-sulphureted variety. The waters are promptly diuretic in their action. Analysis was made by Dr. Robert Peter in 1858, and again in 1887. Following is the result of the former analysis of the salt-sulphur spring:

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	7.20
Iron carbonate	Trace.
Lime carbonate	13.93
Potassium chloride	10.67
Sodium chloride	166.01
Magnesium chloride	55.39
Lime sulphate	Trace.
Iron and bromide	"
Alumina	"
Silica	1.04
Water and loss	78.60
Total	332.84

Gases.

Carbonic acid, Sulphureted hydrogen,	Not estimated.

A re-examination of the waters in 1877 showed essentially the same results. The following additional ingredients were found in minute quantities:

- Baryta carbonate.
- Strontium carbonate.
- Sodium carbonate.
- Calcium chloride.
- Lithium chloride.
- Sodium bromide.
- Sodium iodide.
- Sodium sulphide.
- Boric acid.
- Phosphoric acid.
- Manganese carbonate.

Examination of the two other springs showed the presence of sodium carbonate in the proportion of 20 grains per gallon. One of them contains a little less than 2 grains of iron carbonate to the gallon.

ROCK CASTLE SPRINGS,

PULASKI COUNTY.

Post-office, Rock Castle. Springs Hotel. These springs are located on the Rock Castle River, and are accessible by the Louisville and Nashville and Queen and Crescent R. R. lines. There is daily connection by stage with morning and afternoon trains at London.

The situation is one of great natural charm and beauty, being in the heart of the Cumberland Mountains, at an elevation of over 2000 feet above the sea-level, and surrounded by a vast natural park of pine trees. The pure air and equable temperature, as well as the isolation from the thoroughfares of travel, combine to render the location one of exceptional freedom from the ills of hot weather. A comfortable hotel, with ample arrangements for the comfort of guests, is at hand. The surrounding forests, hills, and fields offer many attractions for the botanist, the naturalist, and the sportsman. The following analysis was made by Dr. Robert Peter:

ROCK CASTLE SPRINGS.

Light Saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Iron carbonate	0.84
Calcium carbonate	2.58
Magnesium carbonate	0.86
Calcium sulphate	0.17
Magnesium sulphate	0.12
Sodium sulphate	3.09
Sodium chloride	0.15
Silica	0.74
Total	8.55

Free carbonic acid gas, considerable quantity.

The waters of the springs have been in use since 1843. They are said to possess excellent tonic and diuretic properties. The location is said to be very beneficial for cases of hay asthma, nasal catarrh, laryngitis, etc.

UPPER BLUE LICK SPRINGS,

NICHOLAS COUNTY.

Access: From Maysville, on the Ohio River, *via* Maysville and Lexington R. R. to within six miles of the springs; thence by carriage.

This spring flows about 1200 gallons of water per hour, having a temperature of 62½° F. in June. The following analysis was made by J. F. Judge and A. Fennel:

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	0.14
Calcium carbonate	25.06
Potassium chloride	1.80
Sodium chloride	516.53
Magnesium chloride	37.72
Potassium sulphate	12.97
Calcium sulphate	44.13
Magnesium iodide	0.15
Magnesium bromide	3.80
Alumina, lime phosphate, iron peroxide	1.96
Silicic acid	1.00
Loss	14.88
Total	660.14
Gases.	**Cubic inches.**
Carbonic acid	48.16
Sulphureted hydrogen	8.16

These are exceptionally fine waters of the saline-sulphureted class. Their effects are aperient and alterative, and they prove efficacious in engorgements of the liver and abdominal organs, gallstones, gastric catarrh, and, combined with the warm baths here, they are valuable in chronic diseases of the skin. The waters of the spring have had an extensive reputation in the West since the early settlement of the country, and they are still sold in bottles in the principal cities of the Ohio and Mississippi Valleys.

WHITE SULPHUR AND TAR SPRINGS,

BRECKENRIDGE COUNTY.

Post-office, Cloverport. Hotel Sulphur Springs. These springs are four in number, and their waters are said to be sulphureted. No quantitative analysis has been made so far as can be learned. Observations relating to their therapeutic value are wanting.

Following are the names and locations of other Kentucky springs whose present status is not known:

Allen Springs, Warren County.

Burgher's Springs, Logan County.
Chalybeate and Saline Springs, Ohio County.
Hickman's Springs, Daviess County.
Howell Mineral Springs, Hardin County.
Indian Spring, Grayson County.
Kentucky Alum Springs, Boyle County.
Kuttawa Mineral Springs, Lyon County.
Miller's Mineral Well, Knox County.
Paroquet Springs, Bullitt County.
Sebree Springs, Webster County.
Sulphur Springs, Union County.
Washington Bell's Sulphur Springs, Nelson County.
White Sulphur Well, Metcalfe County.
Young's Springs, Bath County.

The Anita Springs, at Lagrange, Oldham County, and St. Patrick's Well, at Louisville, Jefferson County, have recently come into use commercially.

LOUISIANA.

The limits of this State extend from 89° and 30′ to 94° west longitude, and from 29° to 33° north latitude. Throughout its entire area the State is a low, alluvial plain, and the southeastern and eastern counties are swampy, while those of the northwest and west, being somewhat hilly, are better drained. Much of the territory bordering on the Mississippi is below the level of the river during the high water, and is protected from inundation by levees of earth similar to the dikes of Holland. The principal river of Louisiana is the Mississippi, which is navigable throughout its entire length in the State for the largest steamer and at all seasons of the year. The Red River, also navigable, extends through the northwestern and central portions of the State. The Washita, in the north, and the Calcasieu, in the south, are the next most important rivers. Many lakes and lagoons are scattered over the State, the largest being Pontchartrain, which is connected with the gulf by Lake Borgne, a navigable body of water.

The climate is warm, but the winters are cold and more variable than in the same latitude on the Atlantic coast. The mean annual temperature, as observed at New Orleans, is 69.06° F., that of the summer being 81.08° F., and of the winter 56° F. The average annual rainfall is about 51 inches.

The mortality-rate in Louisiana in 1890 was 14.62 per thousand; phthisical mortality-rate, 1.35 per thousand of inhabitants.

The mineral springs of Louisiana are five in number, and have not attracted wide attention up to the present time. According to the most recent reports of the United States Geological Survey, no analyses have been made, nor are the waters of any of the springs used commercially. Judging from the geological formation of the State, the waters should be chiefly of the chalybeate or sulphureted variety. We have secured the following account of two localities by correspondence :

DE SOTO MINERAL SPRINGS,

De Soto Parish.

Post-office, Longstreet. Hotel. These springs are located six miles due west from Mansfield, the county seat of De Soto Parish, and three miles south of Grand Cane, both points on the New Orleans, Texas and Pacific R. R. Private conveyances connect with the springs from these stations. This resort has been frequented by residents of the surrounding country for more than forty years. The waters are believed to possess exceptional merit, but the financial depression affecting this section since the late war has prevented their proper development. The springs are pleasantly situated in a gently undulating country, within one hundred and fifty feet of a picturesque stream of clear, sparkling water.

During the season, from July to November, the weather is generally clear and bright, with occasional showers. The springs are three in number, and yield about 60 gallons of water per minute. The average temperature of the water is about 60° F. the year around, which makes it appear quite warm in the winter and cold during the summer months.

No proper analysis has ever been made, but we are informed by Dr. N. P. Reeves, the proprietor, that the water is rich in mineral ingredients, the salts of iron, magnesia, potash, and sulphur predominating. The water has been used with good results in diseases of the liver, stomach, kidneys, and skin. The amount of iron in the water renders it especially valuable in cases of anæmia and chlorosis, as well as in general debility.

WHITE SULPHUR SPRINGS,

Catahoula Parish.

Post-office, White Sulphur Springs. Hotel. Access: The springs are reached by way of Alexandria, La., on the St. Louis, Iron Mountain and Southern, and the Southern Pacific R. R., or by way of Pollock Station, on the Iron Mountain R. R.

The location is in a hilly country, covered with pines. The springs are four in number, and, according to Mr. G. W. Bethards, of the Railroad Hotel, their combined flow is about 30,000 gallons per minute. Like many other enterprises in the South, the resort lacks capital for its improvement. No analysis has been made, but the water has been used with apparent benefit in rheumatism, dyspepsia, Bright's disease, and debility.

The following springs of Louisiana have had more or less reputation as health resorts:

Abita Spring, near Covington, St. Tammany Parish.

Claiborne Springs, near Covington, St. Tammany Parish.

Watch Springs, near the White Sulphur Springs, Catahoula Parish.

MAINE.

The State of Maine is located in the extreme northeastern portion of the United States, and extends from 43° and 5′ to 47° and 30′ north latitude, and from 66° and 50′ to 71° west longitude.

Maine is well supplied with lakes and rivers, the principal streams being the Androscoggin, Kennebec, Penobscot, Grand, St. John, and Saco, besides which there are a vast number of smaller streams which irrigate and drain every section of the State. The Atlantic coast is indented with numerous bays and inlets, which contain an immense number of islands, the largest being Mt. Desert, embracing 60,000 acres. Many attractive summer resorts are found on this coast. The western portion is mountainous, the range being part of the Appalachian system.

The climate is healthful, and the winters, although long and severe, are unmarked by injurious variations, while the summers are pleasant. The mean annual temperature at Portland is 43° F., that of the summer 63.73° F., and of the winter 31.69° F. These figures are the results of observations extending over a period of thirty-seven years.

The average rainfall is about 44.5 inches.

The death-rate of Maine, as computed from the last United States census, was 15.19 per 1000 of population; phthisical mortality-rate, 2.23 per 1000.

The mineral springs of Maine belong to the classes of alkaline-saline and chalybeate waters, the last predominating. Many are sulphureted and a few carbonated. None is thermal, the highest temperature, so far as ascertained, being but 50° F. Most of the temperatures range from 40° to 46° F. The springs of Maine are attracting considerably more attention of late years than formerly. Walton mentions but one locality—Tagus Springs—in Kennebec County,[1] and in some of the older works none whatever is found. There are at this time several charming spring resorts in the State, and, according to the United States Geological Reports for 1894, the waters of no less than fourteen localities are used commercially. Most of them, however, are not used as resorts, and the mineral ingredients of several are so attenuated that they can hardly be referred to as medicinal or healing waters in the strict sense of the term. The following account of the springs of Maine was gathered by personal inquiry and correspondence :

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[1] Not now used as a resort.

ADDISON MINERAL SPRINGS,

WASHINGTON COUNTY.

Post-office, Addison. Hotel and private families. Access *via* steamer from Portland. This spring is located in a charming, hilly section, about one hundred feet above the sea-level and within one-quarter of a mile from an inlet of the ocean. The spring is about five feet in diameter and four feet in depth, and has a steady and rapid flow. The water is very cold at all times, but its temperature is not known. The following analysis, furnished by Mr. W. H. Nash, one of the owners, was made by Prof. Hayes. The figures probably have reference to grains per United States gallon :

ADDISON MINERAL SPRINGS.

Light Alkaline-chalybeate.

Solids.	Grains.
Potassium sulphate	0.60
Sodium sulphate	0.27
Iron bicarbonate	1.65
Calcium sulphate	0.52
Silica and alumina	Traces.
Calcium bicarbonate	2.65
Magnesium bicarbonate	1.12
Sodium chloride	0.89
Sodium bicarbonate	0.44
Total	8.14

These waters have been used with apparent benefit in acid dyspepsia and in certain forms of renal diseases.

BLUE HILL MINERAL SPRING,

HANCOCK COUNTY.

Post-office, Blue Hill. Hotels. Access *via* steamer from Portland, also by stage from Ellsworth, fourteen miles distant.

The Blue Hill Mineral Spring is located two and one-half miles northwest of Blue Hill village, and about six hundred feet in perpendicular height above the base of Blue Hill Mountain. Its situation assures freedom from all surface impurities. The existence of the spring was noticed by Dr. Charles T. Jackson in his second *Report of the Geology of the State of Maine*, published in 1838. It was not until recently, however, that improvements have been made. A handsome and commodious building has been erected for the comfort of tourists and visitors at the springs, and a large bottling plant established. An analysis by Prof. S. P. Sharples, of Boston, resulted as follows :

BLUE HILL MINERAL SPRINGS.

Light Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.29
Sodium sulphate	0.81
Sodium carbonate	0.15
Calcium carbonate	1.87
Carbonate iron	0.59
Silica	1.07
Organic matter	Traces.
Total	4.78

This is an excellent table water, and also possesses mild diuretic and tonic properties. It is used commercially.

Though not highly mineralized, the analysis shows sufficient iron to give the waters valuable tonic and reconstructive properties. It is also an efficient diuretic if taken in considerable quantities.

HIGHLAND SPRING,

ANDROSCOGGIN COUNTY.

Post-office, Lewiston. Cottages. Highland Spring is located in Highland Park, comprising over sixty acres of elevated and wooded land, about two miles from Lewiston Station. The spot offers exceptional advantages to persons wishing to camp during the summer.

The waters of this spring have enjoyed a considerable reputation for a long time past. They are bottled and sold extensively for table purposes. The following analysis was made by Richard C. Stanley, Ph.D., State Assayer of Maine:

HIGHLAND SPRING.

Light Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Iron carbonate	1.10
Iron oxide	0.31
Potassium and sodium carbonate	0.83
Magnesium carbonate	1.23
Potassium and sodium sulphate	0.31
Sodium chloride	1.00
Total	4.78

KEYSTONE MINERAL SPRING,

ANDROSCOGGIN COUNTY.

Post-office, East Poland. This spring is located in the town of Poland, about one mile from the Empire Road Station, on the Grand Trunk Railway, and about two miles from Portland and Rumford

Falls Railway. It is thirty miles from Portland and six miles from each of the two cities of Lewiston and Auburn. The spring is situated on an elevated ridge of land, and the water itself issues from a bed of rock barely discernible from granite, which can be seen in and about the spring. The water flows through a glass pipe direct from the spring into bottles, jugs, etc., which are being filled, and is not taken from storage tanks. According to Prof. Richard C. Stanley, of Bates College, the water contains about three grains of solid matter to the United States gallon, composed as follows:

KEYSTONE SPRING.

Mild Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Iron carbonate	0.45
Iron oxide	0.25
Magnesium carbonate	0.65
Potassium and sodium carbonate	0.30
Potassium and sodium sulphate	0.25
Sodium chloride	0.25
Silica and alumina	0.85
Organic matter	Traces.
Total	3.00

The water is remarkably pure, soft, and wholesome, and well adapted for the table. It is also recommended for dyspepsia and as a mild, unstimulating beverage in inflammatory, renal, and bladder and genito-urinary complaints.

PARADISE SPRING,

CUMBERLAND COUNTY.

Post-office, Brunswick. Hotels and inns. This spring is located about one mile from the centre of the village of Brunswick, and five hundred feet from the Androscoggin River. It is reached by way of the Maine Central R. R. to Brunswick, and thence by Jordan Avenue. The country about the place is level—a sandy plain, covered by pines, extending to beautiful Casco Bay, three miles distant. Concerning the meteorological conditions prevailing about Brunswick, we are indebted to Prof. Leslie A. Lee, of Bowdoin College, for the following description:

"The climate of Brunswick is peculiarly agreeable. Fair weather predominates, the annual number of cloudy days averaging not more than eighty-six in a long period of years. The prevailing winds are from the northwest during the summer and from the southwest during the winter. On this account the air is much drier than would be expected from the proximity of the village to the sea, and fogs rarely occur." Scattered throughout the town are large areas of pine forests, which give a resinous and balmy quality to the air.

The average annual temperature is 44.40° F., rising to an average of 65.11° F. in the summer, and falling to a mean of 22.63° F. in the winter. The temperature of the spring water is about 45° in summer and 43° in winter. The outflow of water is abundant, being estimated at 12,000 gallons per day. The following analysis was made by Prof. Henry Carmichael, of Bowdoin College:

PARADISE SPRING.

Neutral.

One U. S. gallon contains:

Solids.	Grains.
Silica	0.38
Iron oxide	Marked trace.
Calcium sulphate	0.06
Calcium carbonate	0.07
Magnesium carbonate	0.06
Sodium chloride	0.02
Sodium carbonate	0.36
Potassium chloride	0.04
Total	0.99

A more recent analysis by State Assayer Franklin C. Robinson, shows a somewhat larger proportion of solids, viz., 1.05 grains per United States gallon of inorganic salts. The water is remarkably free from organic matter, containing, according to Robinson's analysis, but 0.07 of a grain per United States gallon. This organic matter was found by examination to be of vegetable origin, only a minute trace of nitrogenous material being detected. The water is excellent for table use, and has been supplied to the students of Bowdoin College for some time past. It is used commercially.

POLAND SPRING,

ANDROSCOGGIN COUNTY.

Post-office, South Poland. Springs Hotel. This resort is located in the town of Poland, twenty-five miles north of Portland and ten miles west of Lewiston, at an elevation of about 800 feet above the sea-level. Poland is reached from New York *via* the Fall River or Norwich Line of Steamers, or the New York, New Hampshire and Hartford R. R. to Boston, thence *via* the Boston and Maine R. R. to Portland and Poland Spring; or by way of the Maine Steamship Company, the vessels of which leave New York three times weekly.

The spring boils up from a fissure near the crest of a magnificent mound of the oldest rocks at the rate of about eight gallons of water per minute. The bed of the spring is composed of gneiss, scarcely distinguishable from the original granite, this gneiss being, as the geologists inform us, the oldest of the sedimentary rocks. The unvarying temperature of the water throughout the year, as well as its freedom from organic matter, would indicate a very deep origin. The surroundings of the spring have been extensively improved since 1859, in which year, it is said, the water was first described by a physician. The Poland Spring House was erected in 1876, and after various alterations and additions reached its present superb proportions in 1889. It is situated upon an elevated plateau, and commands a beautiful and diversified view of the surrounding landscape, in which are embraced clustering farms, shining lakes, emerald hills, and in the distance the majestic peaks of the White Mountains. The building contains every desirable adjunct of a modern hotel of the first class. An analysis of the water in 1879 by Prof. F. L. Bartlett, State Assayer and Chemist, resulted as follows:

POLAND SPRING.

Light Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Silica	1.07
Calcium carbonate	1.36
Calcium fluoride	Traces.
Lithia	"
Organic matter	0.28
Potassium sulphate	0.18
Sodium chloride	0.47
Alumina	Traces.
Magnesium carbonate	0.31
Sodium carbonate	0.09
Iron carbonate	Traces.
Total	3.76

This may be classed as a mild alkaline-calcic water, with ferruginous properties. It has long had an extensive reputation in the treatment of rheumatism, gout, and dyspepsia, and in renal and hepatic disorders. It is best known, however, as a table water, for which purpose it has an extensive sale throughout the United States.

POWNAL SPRING,

Cumberland County.

Post-office, West Pownal. Hotel. Location, eighteen miles from Portland and ten miles from Poland Spring. Access *via* Grand Trunk R. R. to West Hanover Station, or Maine Central R. R. to Pownal Spring Station.

The surroundings of the spring are very pleasing to the eye. The White Mountains in the distant northwestern horizon form an impressive background, while to the southward a wide panorama is unfolded to the view of the beholder, even Portland harbor being easily seen by the aid of a small glass. The location of the spring is upon land higher than any other in the immediate vicinity, thus giving no opportunity for surface pollution. The water comes apparently from the solid rock, and is clear and sparkling. The average temperature of the water as it emerges is 42° F. This is subject to a variation of only 1° in either direction during the entire year. The following analysis was made by State Assayer Franklin C. Robinson, Professor of Chemistry at Bowdoin College, in 1893 :

POWNAL SPRING.

Neutral.

One U. S. gallon contains: Solids.	Grains.
Silica	0.41
Iron carbonate	0.04
Calcium carbonate	0.33
Magnesium carbonate	0.02
Sodium carbonate	0.09
Sodium sulphate	0.08
Sodium chloride	0.16
Potassium carbonate	0.02
Total	1.15

Organic and volatile matter, 0.01.

The water is bottled and sold. It is recommended for the table, and is said to be useful in dyspeptic and urinary complaints.

UNDERWOOD SPRING,

CUMBERLAND COUNTY.

Post-office, Falmouth Foreside. This spring is located on the shores of Casco Bay. It yields about 200,000 gallons of water per day, and is said to have been used by white men since the days of Weymouth, the English explorer. The following recent analysis was made by a chemist whose name we have been unable to secure :

UNDERWOOD SPRING.

Neutral.

One U. S. gallon contains: Solids.	Grains.
Sodium chloride	0.86
Silica	0.50
Calcium carbonate	0.48
Magnesium carbonate	0.14
Potassium sulphate	0.12
Organic matter	None.
Total	2.10

The water is used commercially. Being lightly mineralized and entirely free from organic matter, it is well adapted for table use. It is also said to be useful in conditions due to the uric-acid diathesis, gallstones, and urinary irritation, gout, rheumatism, and dyspepsia.

Other springs of Maine are as follows :

Booth Bay Medicinal Mineral Spring, East Booth Bay, Lincoln County; flow, 300 gallons per minute; sulphureted.

Hartford Cold Spring, Hartford, Oxford County; three in number; temperature 45° F.; saline.

Katahdin Mineral Springs, Katahdin Iron Works, Piscataquis County; three in number; sulpho-chalybeate.

Lubec Saline Spring, at the head of Lubec Bay, Washington County. This is the most highly mineralized water in Maine, containing about 268 grains of solids per United States gallon, of which about 166 grains is composed of sodium chloride. The spring is not in use at present, as far as we can learn.

Rosicrucian Springs, Rosicrucian, Lincoln County; three in number; flow, 800 gallons per minute; alkaline-saline.

Summit Mineral Spring, Harrison, Cumberland County; flow, 2280 gallons per hour; alkaline.

The waters of the following springs are sold :

Cold Bowling Springs, Steep Falls, York County.
Crystal Springs, Auburn, Androscoggin County.
Pine Spring, Tapsham, Sagadahoc County.
Wilson Spring, North Raymond, Cumberland County.
Windsor Mineral Spring, Lewiston, Androscoggin County.

MARYLAND.

Maryland extends from 37° 43′ to 39° and 45′ north latitude, and from 75° 10′ to 79° 30′ west longitude, and comprises an area of 11,124 square miles. The State is divided throughout almost its entire length into two unequal parts by the Chesapeake Bay. The surface of the eastern shore is mostly level, and is in parts swampy, but toward the north it is hilly and broken; the northwest is mountainous, being traversed by six ranges of the Alleghanies. The principal rivers of Maryland are the Susquehanna, Potomac, Pocomoke, Micomico, Nanticoke, Choptank, Gunpowder, and Patapsco.

The climate is mild and healthful, being tempered by the proximity of the ocean. The mean annual temperature, as observed at Baltimore, is 54.91° F., that of the summer 75.8° F., and of the winter 34.50° F. The average rainfall is about 41 inches. The rate of mortality, as computed from the United States census of 1890, was 17.27 per 1000 of population; consumptive death-rate 2.22 per 1000 of population.

The mineral springs of Maryland have received but little attention in works on the subject. Pepper's list mentions but one locality, and Walton's work none at all. Several spring resorts once extensively used have been long since abandoned. There are several important resorts in the State, however, and the waters of a number of the springs have recently been placed upon the market. In 1895 116,000 gallons were sold in the eastern part of the

State. The springs are mainly chalybeate, the majority of them being unimproved and unimportant.

BENTLEY SPRINGS,

Baltimore County.

Post-office, Bentley Springs. Hotel, Glen House. These springs are situated on the line of the Northern Central R. R., a division of the Pennsylvania R. R., about thirty miles from Baltimore and seventy miles from Washington. The elevation above tide-water is about 600 feet. In addition to the two principal springs there are perhaps as many as one hundred others, some of which have important chalybeate properties. The surroundings of the springs are exceedingly interesting and attractive. From the portico of the Glen House the eye wanders over an ocean of verdure clothing the neighboring hills, with distant glimpses of cultivated fields through openings among the trees, while the nearby play of sunlit fountains and the merry songs of birds add to the charms of the place. The following analysis of two of the chief springs are by Prof. Aiken, formerly of the University of Maryland:

THE "NUCTA" OR "STATION SPRING."

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	0.34
Sodium carbonate	0.37
Magnesium carbonate	0.27
Calcium sulphate	0.30
Sodium chloride	0.19
Silicic acid	0.33
Iron (a trace), Alumina and loss,	0.02
Total mineral contents	1.82
Organic matter	0.36
Total solid contents	2.18

THE LOWER SPRING.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	0.64
Magnesium carbonate	0.68
Sodium carbonate	0.46
Iron carbonate	0.89
Sodium chloride	0.27
Calcium sulphate	0.35
Silicic acid	0.43
Alumina and loss	0.03
Inorganic contents	3.75
Organic matter	0.91
Total contents	4.66

The water is a mild example of the alkaline-saline-calcic class. It has been used for upward of thirty years in kidney, liver, and stomach disorders, and in chronic bowel affections. It is used commercially.

CHATTOLANEE SPRINGS,

BALTIMORE COUNTY.

Post-office, Chattolanee. Springs Hotel. Access: From Baltimore *via* Northern Central R. R., thirty-three miles. Take train from Calvert or Union Station.

These springs, six in number, are located in the beautiful Green Spring valley, and yield 1,500,000 gallons of water daily. The new hotel on the hill-top, about one hundred and thirty feet above the springs, has an elevation of about 625 feet above tide-water, and possesses all the comforts and conveniences of a modern establishment of the first class. The location of this resort possesses many natural advantages, and to these a liberal management has added numerous features to attract and entertain the visitor. The waters of the spring, though not strongly mineralized, are remarkable for their great purity and freedom from organic matter. The following analysis was made by Lehmann and Mager, of Baltimore. in 1890:

CHATTOLANEE SPRINGS.

Light Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	1.81
Calcium carbonate	4.62
Magnesium chloride	0.21
Sodium chloride	0.11
Sodium sulphate	0.08
Potassium sulphate	0.10
Iron oxide	Trace.
Lithia	"
Silica	0.24
Carbonic acid (combined)	1.11
Total	8.28

Temperature of water at springs, 52° F.

In addition to its properties as a table beverage, this water is said to be very useful in dyspepsia and indigestion and the early stages of Bright's disease. It is extensively sold in Baltimore and other cities.

FLINT STONE SPRINGS,

ALLEGHANY COUNTY.

Post-office, Flint Stone. Hotel. These springs are situated on the eastern slope of the Alleghanies, twelve miles east of the city of Cumberland, from whence they are reached by a carriage drive. The locality has long been noted for its healthfulness and for the beauty and attractiveness of the surrounding mountain scenery. The springs are about 925 feet above the sea-level. According to an old analysis of the principal spring, made by Dr. D. Stewart, of Baltimore, in 1850, one wine-gallon of 231 cubic inches contains 174 grains of solid matter, composed of the following ingredients:

Calcium sulphate.
Magnesium sulphate.
Sodium chloride.
Potassium chloride.
Calcium chloride.
Calcium carbonate.
Potassium carbonate.
Sodium carbonate.
Magnesium carbonate.

The water is of the saline-calcic variety.

Within a mile are several warm springs having a temperature of 64° F.

There are a number of limestone springs nearby, and several warm and cold springs within a mile. The water of the chief spring, the qualitative analysis of which we have given, is beneficial in dyspepsia attended by flatulence and acid eructations, and in debilitated states due to functional disorders of the liver and kidneys.

MARDELA SPRINGS,

(*Formerly Barren Creek Springs*)

WICOMICO COUNTY.

Post-office, Mardela Springs. Hotel. This resort is located on the Baltimore, Chesapeake and Atlantic R. R., twelve miles west of Saulsbury. Under the name of Barren Creek Springs they have been used for medicinal purposes for many years. There is much charming scenery in the neighborhood, and the atmospheric conditions during the summer months are of a very desirable character. The location is about 200 feet above the sea-level.

Messrs. Taylor and Bacon, of the springs, supply us with the following analysis by Prof. P. B. Wilson, of the Baltimore University School of Medicine:

MARDELA SPRINGS.

Chalybeate.

One U. S gallon contains:

Solids.	Grains.
Silica	1.28
Arsenious acid	Strong trace.
Ferric oxide (iron sesquioxide)	11.50
Alumina	0.34
Sodium chloride	0.78
Calcium carbonate	1.35
Magnesium carbonate	0.04
Calcium sulphate	0.01
Sodium carbonate	Trace.
Total	15 30

The water is a strong chalybeate. It is a very efficient tonic and diuretic, and contains sufficient arsenic to give it valuable alterative properties. It promotes the appetite, aids the digestion, and increases the general powers of nutrition. It is highly recommended by physicians of Baltimore in cases of weakness and irritability of the bladder, anæmia, and chlorosis, dyspepsia, chronic cystitis, and urethritis, and in amenorrhœa, leucorrhœa, and other functional disorders of the female pelvic organs when due to debility. The water is found in the Baltimore markets.

STRONTIA MINERAL SPRING,

BALTIMORE COUNTY.

Post-office address, 305 and 307 Exchange Place, Baltimore. No hotel near springs. This spring is located about nine miles from the heart of the city of Baltimore. It is reached by the Green Spring Branch of the Northern Central R. R. to Strontia Spring Station, thence one-half mile to springs. The elevation of the locality is about 600 feet above the sea-level, and the average summer temperature about ten degrees lower than that of Baltimore. An analysis of the spring water made in 1887 by Prof. W. W. Simon, of Baltimore, resulted as follows:

STRONTIA MINERAL SPRING.

Saline-calcic. Strontiated.

One U. S. gallon contains: Solids.	Grains.[1]
Potassium nitrate	2.71
Sodium nitrate	0.83
Sodium chloride	7.50
Magnesium chloride	3.91
Calcium chloride	20.67
Calcium bicarbonate	3.93
Strontium sulphate	0.13
Strontium bicarbonate	1.08
Iron bicarbonate	0.51
Alumina	1.08
Silicic acid	1.19
Phosphoric acid	Traces.
Iodine	"
Ammonia	"
Organic matter	"
Total	43.54
Gases.	Cubic inches.
Oxygen	0.48
Nitrogen	0.71
Carbonic acid	2.04

Since 1876, when the properties of this water were discovered, it has acquired a wide reputation in the treatment of sea-sickness, dyspepsia, gout, rheumatism, and diabetes. It is used commercially and as a table water. It has found its way into many of the leading hotels, clubs, and cafés of New York, Baltimore, and other cities. It is a saline-calcic, and has tonic, diuretic, and alterative properties. It is probable that the considerable quantity of strontium in the water modifies its action to some extent, but in what way cannot be explained in the present state of our knowledge.[1]

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[1] Reduced from parts per 100,000.

In addition to the above-described springs the following were also used as resorts as late as 1886. We have been unable to get more recent information relating to them :

River Springs, River Springs, St. Mary's County; chalybeate; nine in number; flow, 100 gallons hourly.

Spa Spring, Bladensburg, Prince George's County; saline-chalybeate; one spring; flow, 180 gallons hourly.

Windsor Sulphur Springs, Windsor, Carroll County; sulphureted,

The following springs are used commercially:

Carroll Springs, Forest Glen, Montgomery County.

Takoma Springs, Takoma, Montgomery County.

MASSACHUSETTS.

This State extends from 41° 15′ to 42° 55′ north latitude, and from 69° 56′ to 73° 31′ west longitude.

The surface is greatly diversified, the western portion being mountainous, the central portion hilly, and the southeastern low and sandy.

None of the rivers of Massachusetts is navigable, but many of them afford abundant water-power. The principal streams are the Connecticut, which traverses the western portion of the State from north to south; the Housatonic, Merrimac, Blackstone, Taunton, Charles, and Mystic. There are numerous small lakes in the State. On the seacoast are thirty-nine islands, the largest being Nantucket and Martha's Vineyard. Numerous popular summer resorts are found along the coast.

The climate is of a rugged, but salubrious character. The winters are long and severe, while the summers are warm but short. The mean annual temperature, as observed at New Bedford during a period of fifty-eight years, is 48.56° F.; that of the summer is 66.95° F., and of the winter 30.21° F.

The average annual rainfall is about 45 inches. The annual mortality-rate of Massachusetts, according to the latest United States census returns, was 20.15 per 1000 of population. The death-rate from phthisis was 2.67 per 1000 of population.

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[1] Some of the strontium salts are now used in the treatment of epilepsy, diabetes, parenchymatous nephritis, muscular and subacute articular rheumatism, and acute gastritis.

The older works credit Massachusetts with but few mineral spring localities, the latest edition of Walton mentioning only four. Numerous springs have been developed in recent years, however, and in 1895 the commercial output of the State rose to over 2,500,000 gallons, an amount second only to that of Wisconsin. The springs, as a rule, are but slightly mineralized. Most of the waters contain a small quantity of iron, and are alkaline in character. We have obtained the following account of the Massachusetts mineral waters by a personal investigation :

ALLANDALE SPRINGS,

SUFFOLK COUNTY.

Post-office, West Roxbury. These springs, two in number, are not open to the public, and their waters have been withdrawn from the market. An analysis by the State Board of Health, in 1891, showed the water to be of an alkaline character. The springs yield about 1250 gallons of water per hour. It is stated to possess excellent table qualities.

BALLARDVILLE LITHIA SPRING,

MIDDLESEX COUNTY.

This spring is situated in the southern part of Andover, near the Wilmington line. The location of the spring is on the side of a high hill, in a barren, rocky tract of country, with no dwelling within a mile. Land to the extent of fifty acres, belonging to the Ballardville Lithia Company, surrounds the spring. The water is beautifully clear and very pleasing to the taste, especially when charged with gas. The rocky deposits in the neighborhood are said to contain a large proportion of such lithia-bearing minerals as spodumene and lepidolite. We are informed that this fact accounts for the richness of the water in this substance, as shown by the following analysis recently made by Dr. Bennett F. Davenport :

BALLARDVILLE LITHIA WATER.

Lithiated. Chalybeate.

One U. S. gallon contains :

Solids.	Grains.
Lithium carbonate	22.01
Calcium sulphate	0.82
Iron oxide	0.70
Calcium chloride	0.52
Silica	0.46
Total	24.51

This analysis shows a very large proportion of lithia and a very minute proportion of other ingredients. It is said to be valuable in the various conditions produced by the retention of uric acid in the system, notably gout, concretions in the joints, kidneys, and bladder, and certain forms of rheumatism. It is also useful in gouty affections of the skin, bronchial tubes, and kidneys. It is bottled and placed on the market in half-gallon, quart, and pint bottles.

BERKSHIRE SODA SPRINGS,

BERKSHIRE COUNTY.

Post-office, Great Barrington. These springs are within thirty minutes' drive of the famous Berkshire Inn at Great Barrington. The springs are two in number, known as the "Soda" and the "Sulphur," the former yielding about forty quarts, the latter about thirty quarts per minute. No quantitative analysis has been made. The soda spring is said to contain chlorine, carbonic acid, soda, and alumina.

Facilities for hot and cold bathing are provided. Diseases of the blood and skin, and especially rheumatic disorders, are said to be benefited.

COLUMBIA LITHIA SPRING,

SUFFOLK COUNTY.

Post-office, Revere. This spring is located in the town of Revere, Mass., on the line of the Boston and Maine R. R., and thirty minutes by electric cars from the centre of Boston. It is about one mile from Crescent Beach, now a part of the State Park reservation. The spring is located on the side of a hill, and is about 300 feet above the sea-level. The temperature of the water at all times is 48°, and the flow about three gallons per minute. It is very pure and soft, and is recommended by local physicians in disorders of the kidneys, torpidity of the liver, rheumatism, gout, renal calculi, and other conditions resulting from an excess of uric acid in the system. An examination by Griffin and Little, analysts, in 1895, showed the presence of minute quantities of sulphuric acid, lime, magnesia, and chlorine in combination (4.19 grains of mineral matter per United States gallon).

The water is extensively used for table and domestic purposes, about 70,000 gallons being sold in 1896. In connection with the spring is a plant for making carbonated temperance beverages, of which increasing quantities are being used.

COMMONWEALTH MINERAL SPRING,

MIDDLESEX COUNTY.

Post-office, Waltham. This spring is located in the extreme northern part of the town of Waltham. It yields ten gallons of water per minute, having a temperature of 48° F. the year round. An analysis by Prof. S. Dana Hayes, the State Assayer, in 1879, resulted as follows:

COMMONWEALTH MINERAL WATER.

Light Alkaline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium bicarbonate	0.50
Magnesium bicarbonate	0.18
Lime bicarbonate	0.45
Potassium sulphate	0.61
Sodium chloride	0.34
Silicic acid (in solution)	0.37
Iron and alumina	Merest traces.
Total	2,45

The water is naturally charged with oxygen, nitrogen, and carbonic acid gases. It is clear and sparkling and quite free from any appreciable organic matter. The water is bottled and sold extensively in Massachusetts. It is also used in making a number of pleasant beverages. The water is said to have a satisfactory influence in some of the functional disturbances of the liver, kidneys, stomach, and blood.

EVERETT CRYSTAL SPRING,

MIDDLESEX COUNTY.

Post-office, Everett. This spring, which is well known in the New England States, is located in Everett at the junction of Chelsea and Ferry Streets, being within five minutes' walk of the Eastern R. R. depot, and about the same distance from Everett Square. The Middlesex and Chelsea line of surface cars run direct to the Spring House.

The water is but slightly mineralized, but it is remarkably free from organic matter, and is highly recommended for hotel and domestic use. It is sold in tanks, barrels, and jugs in New England.

GOULDING SPRING,

PLYMOUTH COUNTY.

Post-office, Whitman. This spring furnishes an exceedingly pure and palatable water, but, according to an analysis of the State Board of Health, it contains a very minute quantity of solid ingredients, and can hardly be ranked among mineral waters. It is used in the manufacture of beverages and several proprietary products.

MASSASOIT SPRING,

HAMPDEN COUNTY.

Post-office, Springfield. Restaurant at spring. Access: Trolley cars from Springfield run within two miles of the spring. The N. Y., N. H., and H. R. R. is within three-quarters of a mile, and the Boston and Albany R. R. tracks are about two miles away.

The spring is charmingly located about seven miles from Springfield, in a picturesque glen known as the "Bear Hole." It bubbles from the side of a bluff about seventy feet in height and at an elevation of about 250 feet above the level of the sea. The spring furnishes about 7500 gallons of water per hour, having a uniform temperature of about 45° F. the year round. No buildings have been erected for the accommodation of guests other than a restaurant, which is largely patronized by visitors from Springfield, Westfield, Holyoke, Chicopee, and other points during the summer months. The water has been analyized by Prof. Charles Mayer, chemist, with the following result:

MASSASOIT MINERAL SPRING.

Light Saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.36
Lime carbonate	1.38
Magnesium carbonate	0.48
Lime sulphate	0.25
Silica	0.24
Organic substances	0.72
Total	3.43

Traces of potash, iron, alumina, phosphates, nitrates.

The water is remarkably free from micro-organisms and ammonia, and contains only a slight trace of nitrates. It closely resembles the waters of the Poland Spring in Maine. It meets all the requirements of a wholesome table water. It is said to be a great aid to feeble digestion and to assist in overcoming obstinate constipation. The water has an extensive sale, and no doubt in time a resort will be established at the spring.

MOUNT PLEASANT MINERAL SPRINGS,

MIDDLESEX COUNTY.

Post-office, Middlesex. Location: Near Middlesex village. In the twenty-third annual report of the Massachusetts State Board of Health the waters of these springs are shown to be very lightly mineralized. They contain free ammonia, a slight excess of chlorine, with a few nitrates and nitrites.

NOBSCOT MOUNTAIN SPRING,

MIDDLESEX COUNTY.

Post-office, Framingham. Access *via* Northern Division of Old Colony R. R. or Southern Division of Boston and Maine R. R. to station, one and one-half miles distant from the spring. The spring is located five miles from Framingham, at the base of Nobscot Mountain, the highest point in Middlesex County, and comes through crevices in what appears otherwise to be a solid ledge of rock. The water has a uniform temperature of 41° F., and an average flow, summer and winter, of 14,000 gallons per day. The surrounding watershed is a heavily wooded glacial moraine, free from human habitations of any description. Several sanitary analyses have shown the water to be exceedingly pure and wholesome. The following mineral analysis was made in 1891 by Davenport and Williams, of Boston:

NOBSCOT MOUNTAIN SPRING.

Light Saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Organic and volatile matter	0.64
Silica	0.53
Iron oxide and alumina	0.02
Lime carbonate	0.75
Magnesium carbonate	0.23
Sodium chloride	0.36
Sodium carbonate	0.38
Potassium sulphate	0.30
Total	3.21

There is no hotel on the spring property. The water is shipped in glass packages and supplied to the markets of numerous New England towns and cities. The sales in 1896 amounted to slightly more than 600,000 gallons.

SHEEP ROCK SPRING,

MIDDLESEX COUNTY.

Location, Lowell. This is an artesian well bored into the New England black granite. It produces about 2000 gallons of water hourly, having a temperature of 47° F. The water is used commercially. The following analysis was made by State Assayer James F. Babcock:

SHEEP ROCK SPRING.

Neutral.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.19
Sodium sulphate	0.23
Potassium sulphate	Trace.
Calcium sulphate	0.14
Calcium carbonate	0.25
Silica	Trace.
Total	0.81

This cannot be termed a mineral water, as it contains less solid matter than most of the ordinary potable waters of the United States.

SIMPSON SPRING,

BRISTOL COUNTY.

Post-office, South Easton. The spring is located about seven minutes' walk from the railroad station. The water has a temperature of 36° F., and is very pure and wholesome. According to an analysis made in 1884 by Prof. Raphael Pumpelly, chemist to the National Board of Health, the water contains 2.60 grains of solid matter per United States gallon. This consists chiefly of silica and lime, with a trace of iron. The water may be classed as indifferent or neutral. It is used commercially, and is also employed in the manufacture of temperance beverages, extracts, etc.

The following springs of Massachusetts are stated in the United States Geological Reports, Bulletin xxxii., to be used as resorts:

Coldbrook Mineral Springs, Coldbrook Springs, Worcester County; two in number; sulpho-chalybeate.

Echo Grove Mineral Spring, Lynn, Essex County.

The Hopkinton Mineral Springs of Middlesex County—carbonated chalybeate waters—are said to be no longer used as a resort. Several other once famous spring resorts of Massachusetts have also been abandoned.

The Milford Springs, at Amherst Station, Hillsborough County, have been known and frequented since 1818. A new hotel was built in 1883, and the surrounding grounds laid out in an artistic manner. The springs are several in number, and are chiefly of the mild alkaline-saline-chalybeate variety.

The waters are much commended by those who have used them.

The following additional springs are used for commercial purposes:

Abajone Spring, Woburn, Middlesex County.
Belmont Hill Spring, Everett, Middlesex County.
Blue Hill Silver Spring, Milton, Norfolk County.
Burnham Spring, Methuen, Essex County.
Cobanet Spring, Taunton, Bristol County.
Diamond Spring, Lawrence, Essex County.
Electric Spring, Lynn, Essex County.
Harvard Crystal Spring, Allston, Suffolk County.
Indian Spring, Brighton, Suffolk County.
Leland Mineral Spring, Lowell, Middlesex County.
Middlesex Mountain Spring, Malden, Middlesex County.
Moose Hill Spring, Swampscott, Essex County.
Robbin's Spring, Arlington, Middlesex County.

MICHIGAN.

This State extends from 41° 30′ to 47° 31′ north latitude, and from 84° 24′ to 90° 33′ west longitude. It is divided by the Great Lakes into two irregular peninsulas, known as the Upper and Lower Peninsula. The upper or northern portion is rugged, and in some parts mountainous, while the southern section consists of an undulating plain, seldom broken. The principal rivers of the north are the Montreal, Presque Isle, Ontonagon, Menominee, and Escanaba, and of the south the Saginaw, Manistee, Kalamazoo, Clinton, Muskegon, Huron, Pere Marquette, Cheboygan, and Thunder Bay. The Great Lakes on her border give Michigan a coast line of 1624 miles. The State abounds in numerous smaller lakes. The lake and river scenery is celebrated for its beauty and attractiveness. The climate is mild, but the temperature varies considerably, the mean annual temperature as observed at Fort Mackinac being 41.02° F., and at Detroit 47.25° F. The average rainfall varies from 23 inches at Mackinac to 30 at Detroit. The mortality-rate of Michigan, according to the latest census, was 11.95 per thousand of population. The consumptive death-rate was 1.31 per thousand.

Michigan has for many years been well known as a mineral spring State. The State and National Geological Surveys give returns of twenty-one localities used as resorts, besides several that are used commercially. Many of the so-called springs are in reality artesian wells, the water being obtained by boring to a considerable depth. The artesian borings are most numerous in the corniferous limestone and Huron group (Devonian). Owing to the conformation of the strata, which seem to have retained all of their original soluble constituents, all the artesian waters of the State, except those in some outlying, leached-out patches of the Parma sandstone, will be found more or less mineralized. The waters, as a rule, are saline, carbonated, and sulphureted. The brines of the State, also obtained from artesian borings, form an important factor in the industries of the Commonwealth, a large percentage of the salt product of the United States being credited to Michigan. Some of the waters of Michigan were long supposed to possess "magnetic" properties, and are still spoken of under this designation. It has been shown, however, that the magnetic phenomena observed in several of the springs and wells are due to accidental circumstances. In the appended account of the Michigan springs the author is indebted to Peale's list, to the *Magnetic and Mineral Springs of Michigan*, by Dr. Stiles Kennedy, to Walton's work, and to personal communications from a number of localities.

ALMA MAGNETIC MINERAL WELLS,

GRATIOT COUNTY.

Post-office, Alma. Sanitarium and hotel. There are three important mineral wells connected with the Alma Sanitarium. They are, respectively, 2861, 1100, and 226 feet deep. An analysis by Prof. Charles A. Davis, of Alma College, shows the presence of mineral ingredients in large quantities. The waters are of the saline-calcic variety, and possess value in stomach, hepatic, and renal disorders, and in rheumatism.

ALPENA MAGNETIC SULPHUR SPRING,

ALPENA COUNTY.

Post-office, Alpena. Hotels. This celebrated spring or well is situated in the city of Alpena, on Lake Huron. The location is reached by numerous lines of railway and by vessels on the Great Lakes. The vein of water supplying the well was discovered in 1869 by prospectors boring for salt. When a depth of 900 feet was reached an immense volume of water gushed from the pipe with such force as to compel a suspension of operations. Among the phenomena observed by the workmen were the strong odor of sulphur and the apparent magnetic properties of the water. As no salt was found the well was abandoned; but, stimulated by the unusual features of the water, the Alpena Magnetic Sulphur Bath Company was organized in 1891 for fully developing the resources of the vein. Another well was accordingly sunk, which seemed to surpass the first in magnetic properties. At a depth of 1052 feet the drill struck a stratum of lodestone which so profoundly charged the steel drill with positive magnetism that great difficulty was experienced in removing it from the iron casing. It is said that any piece of steel will at once become magnetized if held in the flowing water of the well. A sumptuous bath-house was erected, which, in point of elegance, comfort, and equipment, is not easily surpassed. The building is charmingly located on Thunder Bay, at an elevation of 585 feet above the sea-level. It is abundantly supplied with facilities for Turkish, Russian, vapor, and electric baths. The surface of the country about Alpena is undulating, and the soil of a sandy loam, such as is found in pine regions. We are indebted to Dr. A. M. Miller, of Alpena, for the following facts concerning the meteorology, etc., of this region:

Greatest number of rainy days in a year	187
Least number of rainy days in a year	151
Greatest number of cloudy days in a year	199
Least number of cloudy days in a year	113
Greatest number of clear days in a year	115
Least number of clear days in a year	50

The winter temperature ranges from 58° F. to 27° F.; summer 98° F. to 34° F. The average for the year is 41° F. The temperature of the water ranges from 40° F. in April to 67.6° F. in August, falling again to 36.1° F. in November. The following analysis was made in 1892 by Prof. Edwards, of the University of Michigan:

ALPENA MAGNETIC SPRING.

Saline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	1.67
Sodium chloride	243.89
Magnesium chloride	78.22
Sodium sulphide	28.05
Calcium sulphide	182 56
Total solids	534.39

Sulphureted hydrogen gas, 7.38 cubic inches per gallon.

The waters have been used, and with gratifying results, in cases of rheumatism, syphilis, neurasthenia, dyspepsia, Bright's disease, and certain skin affections, especially eczema, psoriasis, and lichen. The internal use of the waters has been found advantageous in cases of constipation, diabetes, and vesical catarrh.

The population of Alpena, as given in the *Michigan State Gazette* of 1892, was 15,000. It is in all respects a city of progress, and contains all the advantages of the recent inventions in electricty as well as gas, water-works, etc.

AMERICANUS MINERAL WELL,

(*Formerly Michigan Congress Well*)

INGRAHAM COUNTY.

Post-office, Lansing. Access: By numerous railroads to the city of Lansing.

The water of this well, under the name of the Michigan Congress Water, has been in use for many years past. We present an anlysis which we believe was made by Dr. Jennings, of Detroit:

AMERICANUS MINERAL WELL.

Alkaline-saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium phosphate	25.04
Sodium chloride	183.84
Sodium bicarbonate	93.40
Magnesium bicarbonate	67.13
Iron carbonate	3.06
Lithium carbonate	0.08
Calcium carbonate	85.90
Potassium sulphate	12.45
Silica	33.00
Aluminium	Traces.
Sodium iodide	Trace.
Calcium phosphate	"
Total	503.90

Carbonic acid, 190.29 (grains ?).

The temperature of the water remains at 53° F. the year round. The water is highly recommended in cases of acid dyspepsia, the headache following alcoholic excesses, etc. It has also been used successfully in cases of lumbago, gout, and various urinary and renal disorders. The water is bottled and sold.

BUTTERWORTH'S MINERAL SPRING,

KENT COUNTY.

Post-office, Grand Rapids. This spring is located on Huron Street, in the city of Grand Rapids. Adjoining is a commodious bath-house, with suites of rooms on separate floors for ladies and gentlemen (Walton). The analysis is by Dr. S. P. Duffield :

BUTTERWORTH'S MAGNETIC MINERAL SPRING.

Saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium bicarbonate	5.00
Calcium bicarbonate	8.34
Magnesium bicarbonate	5.85
Iron bicarbonate	0.97
Calcium sulphate	75.15
Sodium chloride	12.73
Potassium chloride	9.60
Calcium chloride	6.10
Magnesium chloride	41.86
Alumina	0.41
Silica	0.52
Organic matter	0.67
Total	167.20

The water has a considerable resemblance to that of Bath, England. It contains, however, a much larger proportion of chloride of magnesium.

CLARK'S RED CROSS MINERAL WELL,

MECOSTA COUNTY.

Post-office, Big Rapids. This water was discovered on the farm of A. L. Clark, adjoining the southern limits of the town of Big Rapids, in June, 1890. The workmen were boring for gas, but at the depth of 1300 feet struck an immense vein of water with a pressure so heavy that it is said the drill, weighing nearly 2500 pounds, was borne up with it. The water was submitted to Prof. Albert B. Prescott, of the University of Michigan, who found the following list of mineral ingredients :

CLARK'S RED CROSS MINERAL WELL.

Muriated-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	13,048.59
Magnesium chloride	1,390.78
Calcium chloride	3,261.18
Sodium bromide	86.95
Calcium sulphate	33.24
Iron carbonate	4.46
Silicic acid	0.07
Aluminium	Traces.
Potassium	"
Total	17,825.27

Specific gravity at 62° F. (16.6° C.), 1205.
Weight of one U. S. gallon of the water, 70,273.19 grains.
Reaction, neutral before and after boiling.
Filters clear and colorless.

The analysis shows this to be one of the most heavily mineralized waters known. A bath-house for the local use of the water has been erected on Maple Street, opposite the Northern Hotel, and the water is also used commercially. For internal use it is recommended in very small doses—from one-half to two teaspoonfuls four times a day, diluted with plain water. It is said to act as an emetic or purge if taken too strong.

The water is recommended for numerous internal disorders, and also for its local effects in ulcers, cuts, burns, or bruises; as a lotion in conjunctivitis, a gargle in pharyngitis, an injection in leucorrhœa, gonorrhœa, etc. The hot baths are stated to be of great value in old cases of obstinate rheumatism. The water is odorless, and it is said that it never freezes at any temperature known in Michigan.

CLARK'S RIVERSIDE MINERAL SPRINGS,

WAYNE COUNTY.

Post-office, Detroit. This resort is located on Fort West Street, corner of Clark Avenue, about two miles from the centre of the city of Detroit. It is reached by electric cars, which pass the door of the bath-house every five minutes. This bathing establishment, which was recently opened to the public, is one of the most elegant and luxurious to be found in the country. The springs are two in number, and furnish an abundant flow of water. An analysis by Samuel P. Duffield, M.D., Ph.D., made in November, 1889, resulted as follows:

CLARK'S RIVERSIDE MINERAL SPRINGS.

Muriated-sulphated. Saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	3408.50
Potassium chloride	0.18
Calcium chloride	860.00
Calcium sulphate	1790.98
Magnesium sulphate	1082.02
Magnesium carbonate	11.22
Calcium carbonate	149.16
Silica	3.50
Alumina	13.41
Total grains per U. S. gallon	7,318.97

Sulphureted hydrogen gas, 40.76 cubic inches.
Temperature of water, 56° F.

The bath-house is kept open all the year. The waters have been found very useful in the diseases to which the saline-calcic class is applicable.

EASTMAN SPRINGS,

BERRIEN COUNTY.

Post-office, Benton Harbor. Hotel. Benton Harbor is in the midst of the fruit-belt of Michigan, sixty miles from Chicago and ninety miles from Milwaukee. The springs are nineteen in number. Following are analyses of some of the representative springs:

"KING DAVID" SPRING (EASTMAN SPRINGS).

Calcic-chalybeate.

(W. S. Haines, analyst, 1882.)

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.11
Sodium bicarbonate	0.67
Potassium sulphate	0.14
Calcium bicarbonate	8.12
Magnesium bicarbonate	3.53
Iron bicarbonate	1.29
Manganese phosphate	Well-marked traces.
Alumina	0.11
Silica	0.58
Total	14.55

Carbonic acid gas, 38.96 cubic inches.

"SILVER QUEEN" (EASTMAN SPRINGS).

Alkaline-calcic.

(W. S. Haines, analyst, 1882.)

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.09
Sodium bicarbonate	1.36
Potassium bicarbonate	1.07
Potassium sulphate	Traces.
Calcium bicarbonate	6.80
Magnesium bicarbonate	3.22
Silica	0.11
Total	12.65

Carbonic acid gas, 35.46 cubic inches.

"SILVER KING" (EASTMAN SPRINGS).

Alkaline-calcic.

(H. G. Garrison, analyst, 1889.)

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.10
Sodium bicarbonate	1.13
Potassium bicarbonate	1.05
Potassium sulphate	Traces.
Calcium bicarbonate	5.02
Magnesium bicarbonate	3.12
Lithium bicarbonate	3.03
Manganese phosphate	0.01
Silica	0.11
Total	13.57

Free of organic matter.
Carbonic acid gas, 49 cubic inches.

"BIMINI" (EASTMAN SPRINGS).

Alkaline-calcic.

(E. G. Smith, analyst, 1894.)

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	0.05
Sodium sulphate	0.52
Sodium chloride	0.10
Sodium phosphate	0.01
Sodium borate	Trace.
Sodium bicarbonate	0.26
Magnesium bicarbonate	3.55
Calcium bicarbonate	7.48
Iron bicarbonate	0.07
Alumina	0.03
Silica	0.54
Total	12.61

Gas not estimated.

"GOLDEN FOUNTAIN" (EASTMAN SPRINGS).

Alkaline-calcic.

(E. G. Smith, analyst, 1894.)

One U. S. gallon contains :

Solids.	Grains.
Potassium sulphate	0.11
Sodium sulphate	0.26
Sodium phosphate	0.04
Sodium chloride	0.09
Magnesium sulphate	0.18
Magnesium bicarbonate	3.21
Calcium bicarbonate	8.20
Iron bicarbonate	0.38
Manganese bicarbonate	Trace.
Alumina	0.01
Silica	0.40
Total	12.88

Gas not estimated.

Other well-known springs are the "Colonel's Own," the "Saul," the "Psyche," and the "Winans." This is quite a remarkable group of springs. They all appear to be more or less carbonated, some of them quite heavily so. They differ from most of the springs of Michigan in containing a much smaller proportion of chloride of sodium. The waters undoubtedly possess medicinal value of a high order. Facilities for mineral and mud baths will be found at the springs; the waters are also used commercially.

EATON RAPIDS WELLS,

EATON COUNTY.

Post-office, Eaton Rapids. Numerous hotels. Access from Jackson, Mich., *via* Grand River Valley R. R. to Eaton Rapids, twenty-four miles northwest.

The town of Eaton Rapids is pleasantly situated on the Grand River. The wells were discovered in 1869 and 1870, and have drawn considerable attention to the place. Several of the wells are connected with the hotels, and all facilities for bathing are offered.

The following analyses were made before the insertion of the first tubing, and it is probable that a considerable proportion of surface water was contained in that submitted for examination. Springs 1, 2, and 3 were analyzed by R. C. Kedzie, and 4 by C. T. Jackson :

EATON RAPIDS MAGNETIC SPRINGS AND WELLS.

Alkaline-calcic-chalybeate.

One U. S. gallon contains: Solids.	Bodine Spring. Grains.	Mosher Spring. Grains.	Shaw Spring. Grains.	Sterling Spring. Grains.
Sodium carbonate	...	5.38	11.57	...
Sodium bicarbonate	5.05	...	...	...
Potassium carbonate	...	1.15	1.27	...
Potassium bicarbonate	3.00	...	...	...
Calcium carbonate	...	19.43	20.74	...
Calcium bicarbonate	40.47	...	...	...
Magnesium carbonate	...	4.52	3.84	...
Magnesium bicarbonate	8.40	...	...	...
Iron carbonate	...	...	...	2.80
Iron bicarbonate	2.25	1.00	2.23	...
Sodium sulphate	...	...	...	12.59
Calcium sulphate	57.50	45.16	48.13	55.20
Magnesium sulphate	...	...	...	9.40
Sodium chloride	1.50	0.90	0.90	5.21
Silica	2.00	2.54	1.40	...
Organic matter, Loss,	...	0.85	0.90	...
Total	120.17	80.93	90.98	85.20
Gas.	Cubic ins.	Cubic ins.	Cubic ins.	Cubic ins.
Carbonic acid	17.35	15.38	15.97	...

FRUIT PORT WELL,

MUSKEGON COUNTY.

Post-office, Fruit Port. This well is located in the town of Fruit Port, on the Chicago and Michigan Lake Shore R. R., one hundred and sixteen miles north of Chicago. It was formerly much patronized by citizens of Chicago. The following analysis by C. G. Wheeler shows the character of the water:

FRUIT PORT WELL.

Saline-calcic-chalybeate.

One U. S. gallon contains: Solids.	Grains.
Sodium bicarbonate	6.52
Calcium bicarbonate	5.11
Magnesium bicarbonate	4.15
Iron bicarbonate	7.50
Manganese bicarbonate	0.10
Sodium sulphate	46.00
Sodium chloride	464.03
Potassium chloride	0.43
Calcium chloride	111.11
Magnesium chloride	46.81
Bromides	0.77
Alumina	Trace.
Silica	10.60
Total	703.13

Carbonic acid gas, 7 cubic inches.

HUBBARDSTOWN WELL,

IONIA COUNTY.

Post-office, Hubbardstown. This place is six and one-half miles from Pewamo, a town on the Detroit and Milwaukee R. R., 113 miles northwest of Detroit. According to an analysis by Prof. P. H. Douglass, the water contains the following ingredients :

HUBBARDSTOWN MINERAL WELL.

Alkaline-calcic-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	7.35
Calcium carbonate	16.54
Iron protoxide	0.15
Silica	0.13
Total	24.17

A bath-house was erected some years ago.

GRAND HAVEN MINERAL SPRING,

OTTAWA COUNTY.

Post-office, Grand Haven. This is the terminal station on Lake Michigan of the Detroit, Grand Haven and Milwaukee R. R. It can also be reached from Chicago by lake steamer. The location is a cool and pleasant place in the summer, and excellent opportunities are afforded for surf bathing in the lake. According to an analysis by C. G. Wheeler, the water is composed as follows :

GRAND HAVEN MINERAL SPRING.

Muriated-saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	2.09
Potassium carbonate	2.74
Calcium carbonate	2.01
Magnesium carbonate	1.52
Iron carbonate	0.08
Sodium sulphate	71.29
Sodium chloride	306.03
Potassium chloride	1.93
Calcium chloride	148.05
Magnesium chloride	71.53
Magnesium iodide	0.05
Magnesium bromide	0.17
Calcium fluoride	0.05
Alumina	0.30
Silica	1.05
Total	608.89

This water contains sufficient sulphate of soda to give it great efficacy in cases of engorgement of the liver, abdominal plethora, and dyspepsia associated with these conditions.

LESLIE WELL,

INGHAM COUNTY.

Post-office, Leslie. Access from Jackson *via* the Jackson, Lansing and Saginaw R. R. to Leslie, fifteen miles north.

This is a very good calcic water, with sufficient iron to give it tonic properties. Analysis by Prof. R. C. Kedzie :

LESLIE MINERAL WATER.

Calcic-chalybeate.

One U. S. gallon contains : Solids.	Grains.
Sodium bicarbonate	5.27
Potassium bicarbonate	4.55
Calcium bicarbonate	30.62
Magnesium bicarbonate	10.53
Iron bicarbonate	2.27
Calcium sulphate	7.04
Alumina	2.08
Silica	0.65
Total	63.01

Carbonic acid gas, 13.05 cubic inches.

MOORMAN MINERAL WELL,

WASHTENAW COUNTY.

Post-office, Ypsilanti. The waters of the Moorman Well are used to supply the Occidental Bath-house, which is situated near the centre of the charming city of Ypsilanti, on the line of the Michigan Central and the Lake Shore and Michigan Southern R. R. The bathing establishment contains forty large, well-ventilated bath-rooms, besides parlors for ladies and gentlemen, smoking- and reading-rooms, and other adjuncts of a modern first-class institution of this kind. The water of this well has been in use since 1848, and has become widely known. The baths are highly recommended in uterine inflammations and congestions, in skin diseases, sciatica, and inflammatory rheumatism and gout. Internally the water is said to be valuable in constipation, dyspepsia, chronic alcoholism, and in hay-fever. It is also used as an insufflation, douche, or gargle in nasal and pharyngeal catarrh. The analysis was made by James H. Shepard, of the Ypsilanti High School, in 1884 :

MOORMAN MINERAL WELL.

Saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	103.76
Potassium sulphate	35.33
Ferrous salts	Traces.
Calcium sulphate	175.65
Magnesium bromide	10.97
Sodium sulphide	8.42
Phosphates	Traces.
Silicon dioxide	19.81
Calcium carbonate	57.26
Borates	Traces.
Sodium chloride	1573.62
Lithium salts	Traces.
Calcium chloride	143.35
Barium salts	Traces.
Magnesium chloride	128.09
Strontium salts	Traces.
Organic matter	"
Total	2256.26

Sulphureted hydrogen gas, 26.84 cubic inches.

The bath-house is connected with the new Occidental Hotel, where ample arrangements are made for the comfort of guests.

Ypsilanti also contains several other well-known mineral wells. The most important of these are the Ypsilanti and Owens Wells. They are highly charged with mineral ingredients, and are also of the saline-calcic class.

MT. CLEMENS MINERAL SPRINGS,

MACOMB COUNTY.

Post-office, Mt. Clemens. Hotels. Access from Detroit *via* Chicago and Grand Trunk R. R., twenty miles northeast. These waters are very strong brines, as shown by the following analyses made by Prof. S. P. Duffield:

MT. CLEMENS MINERAL SPRINGS.

Saline.

One U. S. gallon contains: Solids.	Mt. Clemens Mineral Well. Grains.	Media Spring. Grains.	Soolbad Spring. Grains.
Calcium carbonate	0.98	91.00	Trace.
Magnesium carbonate	0.70	0.70	"
Iron carbonate	5.60	...	...
Sodium sulphate	...	...	...
Calcium sulphate	100.56	14.30	44.00
Potassic salts	...	Trace.	Trace.
Sodic salts, Calcic salts, Magnesic salts,	...	11,741.00	11,181.00

One U. S. gallon contains: Solids.	Mt. Clemens Mineral Well. Grains.	Media Spring. Grains.	Soolbad Spring. Grains.
Iron sulphide	...	...	...
Sodium chloride	11,900.00	...	...
Calcium chloride	934.50	...	...
Magnesium chloride	648.48	...	...
Magnesium iodide	0.07	...	...
Magnesium bromide	6.37	...	...
Iron	...	8.50	Trace.
Alumina	29.47	29.00	11.12
Silica	27.60	28.00	...
Bromide	...	8.50	Trace.
Iodine	...	0.07	0.05
Ammonia	...	Trace.	Trace.
Organic matter	...	...	...
Total	13,654.33	11,921.07	11,236.26
Gases.	Cubic ins.	Cubic ins.	Cubic ins.
Hydrogen sulphide or dihydric sulphide	40.00	40.00	33.00
Carbonic acid	5.85	...	...
Nitrogen	Present.	...	...

These waters resemble those of Achsel-Mannstein, in Bavaria. It is necessary to dilute them both for internal use and for bathing. They have acquired considerable reputation in the treatment of scrofulous disorders of the skin, bones, and joints, and for the improvement and even cure of paralysis when the disease depends chiefly upon innervation without decided lesion of the brain or spinal cord. Cases of chronic rheumatism with stiffened joints and obstinate cases of neuralgia may also find relief.

The waters are used commercially.

OWOSSO SPRING,

SHIAWASSEE COUNTY.

Post-office, Owosso. Access: Owosso is a station on the Detroit and Milwaukee R. R., seventy-nine miles northwest from Detroit.

The following analysis was made by a chemist whose name has been lost:

OWOSSO MINERAL WATER.

Chalybeate.

One U. S. gallon contains: Solids.	Grains.
Calcium bicarbonate	25.67
Magnesium bicarbonate	19.09
Iron bicarbonate	15.92
Sodium chloride, Potassium chloride,	2.10
Alumina, Silica,	0.62
Total	63.40

This water, as shown by the analysis, is very heavily impregnated with iron. As the name of the analyst is not known, the analysis is not reliable.

PLYMOUTH ROCK MINERAL WELL,

WAYNE COUNTY.

Post-office, Plymouth. Plymouth is a handsome village of about 1800 inhabitants, twenty-three miles west of Detroit, from whence it is reached by both the Flint and Pere Marquette and the Grand Rapids and Western R. R. The well is situated in a picturesque spot on the farm of Dr. M. V. B. Saunders. It was bored several years since, and an analysis was made by Prof. John E. Clark, of Detroit, in 1893:

PLYMOUTH ROCK MINERAL WATER.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	14.38
Sodium sulphate	0.37
Sodium bicarbonate	5.27
Potassium bicarbonate	1.73
Calcium bicarbonate	5.47
Magnesium carbonate	2.90
Alumina and iron carbonate	1.73
Silica	0.50
Organic and volatile matter	1.29
Total	33.64

Lithium carbonate and carbonic acid gas not estimated.

No accommodations have so far been prepared for visitors, but the water is widely sold. It is a good example of the alkaline-saline carbonated variety, and is useful in conditions to which this class is applicable. Its best effects have been observed in disorderd states of the stomach, especially when accompanied by hyperacidity. It is also highly recommended in irritable states of the bladder and kidneys as a diuretic and diluent of the urine. It is said to have produced excellent results in gout, rheumatism, gravel, and other affections.

SPRING LAKE WELL,

OTTAWA COUNTY.

Post-office, Spring Lake. Hotel. Spring Lake is a station on the Detroit and Milwaukee R. R., three miles east of Grand Haven. The town is located on a beautiful sheet of water of the same name, five miles long and one mile wide. The resort owes its rise to the citizens of Chicago, who frequent it in considerable numbers (Walton). The following analysis was made by Prof. C. G. Wheeler:

SPRING LAKE WELL.

Muriated-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium bicarbonate	0.05
Calcium bicarbonate	0.13
Magnesium bicarbonate	0.01
Iron bicarbonate	1.01
Sodium sulphate	46.70
Sodium chloride	405.53
Potassium chloride	4.29
Manganese bicarbonate	0.05
Calcium chloride	113.42
Magnesium chloride	36.20
Bromides	2.17
Lithia	Trace.
Alumina	"
Silica	0.50
Ammonia	0.02
Organic matter	18.29
Total	628.37

In chemical composition this water resembles the Edisenquelle, of Kreutznach.

ST. CLAIR SPRINGS,

ST. CLAIR COUNTY.

Post-office, St. Clair Springs. Hotel, The Oakland. Access from Detroit by steamer from the foot of Griswold Street, twice daily; distance, fifty miles. Also from Detroit *via* Grand Trunk Railway (foot of Brush Street), twice daily; distance, fifty-one miles. Railroad connection for springs can also be made at St. Thomas, Ont., *via* Canada Southern R. R. Steamer connection once daily is made at Port Huron, Mich.

St. Clair Springs is one of the strictly first-class health and pleasure resorts of the United States. The Oakland Hotel, situated in a tract of about 165 acres fronting on the St. Clair River, at the extreme southern portion of the city of St. Clair, affords all the comforts, conveniences, and luxuries to be found at our older Eastern resorts or at the European spas. The hotel is open for the reception of health or pleasure seekers all the year round. Two classes of mineral waters of very pronounced yet very different type are found here. The first of these is a powerful muriated-saline. The analysis is by Prof. Duffield:

ST. CLAIR MINERAL SPRING.

Muriated-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	8,120.00
Calcium chloride	7,382.20
Magnesium chloride	1,012.20
Calcium sulphate	144.20
Magnesium carbonate	Traces.
Calcium carbonate	"
Magnesium iodide	"
Magnesium bromide	"
Silica	416 00
Alumina	830.00
Total	17,904.60

Sulphureted hydrogen gas, 25.59 cubic inches.

It will be observed that the water contains an unusually large quantity of chloride of lime. The salt is believed by some observers to possess valuable alterative properties and to be of great assistance in the treatment of the strumous diathesis. The water also possesses all the well-known virtues of the densely charged chloride of sodium groups.

An elegant and elaborate bath-house presenting all varieties of baths, sprays, douches, etc., is maintained in connection with the hotel.

The "Salutaris" is a natural gaseous alkaline mineral water, very wholesome and pure. It is said to be entirely free from organic matter. The following analysis was made by Prof. Charles F. Chandler, of Columbia University, New York City:

SALUTARIS SPRING (ST. CLAIR SPRINGS).

Alkaline-saline. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	81.33
Potassium chloride	1.69
Potassium sulphate	Traces.
Sodium bicarbonate	4.87
Calcium bicarbonate	5.13
Magnesium bicarbonate	3.88
Ammonium bicarbonate	Traces.
Silica	0.57
Organic matter	Traces.
Total	97.47

Carbonic acid gas, 465.32 cubic inches.

This is an excellent table water. It is miscible with all kinds of wines and liquors, as well as with buttermilk, whey, cream, sweet milk, and fruit syrups. It has a very beneficial influence in cases of acid dyspepsia and feeble digestion, and it is said by some physicians to be a factor in restraining the loss of albumin in Bright's disease. It is bottled and is extensively sold throughout the United States. The attractions in and about the Oakland Hotel are of a manifold character. Expansive shaded lawns, picturesque drives, boating and sailing on the river and all the indoor pastimes of the day will be found here.

ST. LOUIS SPRING,

GRATIOT COUNTY.

Post-office, St. Louis. Hotels and sanitariums. Analysis by S. P. Duffield:

ST. LOUIS SPRING.

Alkaline-calcic-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium bicarbonate	88.66
Calcium bicarbonate	57.83
Magnesium bicarbonate	14.58
Iron bicarbonate	1.00
Calcium sulphate	55.41
Calcium silicate	5.60
Silica	2.40
Organic matter, Loss,	1.66
Total	227.14
Gases.	**Cubic inches.**
Sulphureted hydrogen	Trace.
Carbonic acid	5.17

The results of treatment with these waters, according to Dr. Stiles Kennedy, show them to be especially beneficial in dyspepsia, neuralgia, and chronic rheumatism. The water, as shown by the analysis, is strongly alkaline, and also contains sufficient iron to impart to it the properties of the chalybeate class. The waters were once supposed to be strongly magnetic, but it has been proved by the experiments of Walton, and corroborated by a committee of the Michigan State Medical Society, that the so-called magnetic properties were derived from the metallic tubing which encased the well. The resort is still kept up well and is very popular.

The Midland Magnetic Well, of Midland County; the Otsego Mineral Springs, of Allegan County, and the Wyandote White Sulphur Springs, of Wayne County, have also been used as resorts. The Blue Rock Spring, Grand Rapids, Kent County; The No-Che-Mo Spring, Reed City, Osceola County, and the Zauber Wasser Spring, Hudson, Lenawee County, are used commercially.

MINNESOTA.

Minnesota extends from 43° 30′ to 49° north latitude, and from 89° 29′ to 97° 5′ west longitude.

The State contains the crest of the great low plain of North America, and occupies nearly the centre of the continent. The surface of the State is an undulating plain, with an average elevation of 1000 feet above the sea, but in the northeast there is a group of low sand hills which rise about 600 feet higher.

The principal rivers are the Mississippi, the St. Croix, the Minnesota, the Red River of the North, and the St. Louis, all of which are navigable, and which, with their numerous tributaries, irrigate and drain every portion of the State. The Falls of St. Anthony, at Minneapolis, and the Minnehaha, made famous by Longfellow in "Hiawatha," are well known throughout the country. The surface is also dotted with an immense number of lakes. The climate is salubrious and invigorating, the summers being cool and pleasant, and the winters, although severe, rendered very comfortable by the clearness and dryness of the atmosphere. The winter climate of the State is found to be suitable in many cases of consumption.

The death-rate for Minnesota by the last United States census was 11.89 per 1000 of inhabitants; phthisical death-rate 1.17 per 1000 of population.

There are a considerable number of mineral springs in Minnesota, but few of them have been brought into public notice. No previous work on the subject credits the State with a single locality used as a resort (with the exception of Peale's list). A majority of the springs analyzed show the presence of iron generally in small quantities. We have obtained an account of two localities by correspondence:

INDIAN MEDICAL SPRING,

SHERBURNE COUNTY.

Post-office, Elk River. This place is reached by the Great Northern and Northern Pacific R. R.

The spring is located four miles northwest of the village of Elk River and thirty-four miles north of Minneapolis. The surrounding country is of a hilly character, and the elevation of the location above the sea-level is stated to be about 5000 feet.[1] The spring flows about 1800 gallons per hour. No resort has yet been established here, but the water is used commercially, about 252,000 gallons having been sold in 1896. Two analyses have been made, one by Dr. Charles W. Drew, the other by Dr. A. F. Irwin, which show substantially the same result. The estimates have been presumably made in grains per United States gallon :

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[1] Doubtless an error. The elevation is nearer 1000 feet.—J. K. C.

INDIAN MEDICAL SPRING.

Alkaline-calcic-chalybeate.

(Charles W. Drew, analyst, 1893.)

Solids.	Grains.
Potassium sulphate	0.40
Sodium chloride	0.38
Sodium sulphate	0.30
Sodium bicarbonate	1.14
Calcium bicarbonate	4.14
Magnesium bicarbonate	2.00
Iron bicarbonate	0.09
Alumina	0.03
Silica	1.04
Organic matter	0.58
Total	10.10

Carbonic acid gas, heavily charged.
Sulphureted hydrogen gas, faintly charged.

The water is a very good diuretic, and is highly extolled in the treatment of dyspepsia, rheumatism, and skin diseases.

WHITE MINERAL SPRINGS,

Winona County.

Post-office, Minnesota City. Boarding-houses. Access *via* Chicago and Northwestern, the Milwaukee and St. Paul, and the Winona and Southwestern R. R. to Minnesota City, the depot being two miles from the springs. A good wagon road connects the resort with Winona, eight miles distant.

The springs, two in number, are located in a rather hilly, romantic stretch of country at a level of 650 feet above the sea. The summer temperature ranges from about 60° F. to 90° F.; winter, 15° F. to 60° F. The temperature of the water is about 45° F. An analysis of one of the springs by Prof. W. A. Noyes, of the State University at Minneapolis, resulted as follows :

WHITE MINERAL SPRINGS.

Alkaline-calcic.

One U. S. gallon contains :

Solids.	Grains.
Potassium carbonate	0.09
Potassium sulphate	0.04
Potassium nitrate	Trace.
Sodium sulphate	0.44
Sodium chloride	0.29
Calcium carbonate	10.61
Magnesium carbonate	6.08
Lithium carbonate	Trace.
Silica	0.95
Alumina	0.14
Total	18.64

Warm and cold baths are provided at the springs, and the water is also used commercially.

According to Prof. N. H. Winchell's reports on the geology and natural history of the State, the following springs have been more or less resorted to :

Geisenger Spring, Rochester, Olmstead County.

Owatonna Mineral Springs, near Owatonna, Steel County. These springs are nine in number, and of the alkaline-calcic class.

The following are used commercially:

Inglewood Springs, Minneapolis, Hennepin County.

Mankato Mineral Springs, near Mankato, Blue Earth County.

MISSISSIPPI.

This State extends from 30° 20′ to 35° north latitude, and from 88° 12′ to 91° 40′ west longitude.

The surface is undulating, with an elevation in the north and northeast of from 400 to 700 feet, some of the hills rising from 200 to 300 feet above the surrounding country. There is a general slope to the south and southeast. The central and southern portions are generally hilly, though there are numerous marshes in the extreme south.

The principal rivers are the Mississippi, which washes the western shore; the Yazoo, Big Black, Homochitto, Tombigbee, Pascagoula, Pearl, and Tennessee.

The climate is warm, the winters being short and mild and the summers long and hot. The higher lands are healthful, but along the rivers malarial diseases are frequent, and occasionally assume an epidemic character. The mean annual temperature, as observed at Vicksburg, is 65.57° F.; that of the summer 80.52° F., and of the winter 50.45° F. The average rainfall is probably higher than that of any other State in the Union, being about 54 inches, ranging from 48 inches in the northwest to 64 inches on the Gulf coast. The mortality-rate for the State in 1890 was 11.55 per 1000 of population; phthisical death-rate, 1.11 per 1000.

The mineral springs of Mississippi are numerous, and, like those of the neighboring States, are highly chalybeate. According to Prof. E. W. Hilgard, few neighborhoods in the State are without a mineral spring or well of some kind. Waile's report on the geology of Mississippi states that along the whole extent of the Yazoo and Tallahatchee valleys, and the whole front below, on the Mississippi River, copious springs issue from the bluffs, the water flowing from beds of ocherous earth and pyritous clays. The water is highly charged with sulphate of iron, and its habitual use is very pernicious. Many of the springs have considerable local reputation, and appear to be used somewhat indiscriminately by the residents for medicinal purposes. Dr. Peale gives a list of twenty spring localities in the State which have been more or less used as resorts. A number of these were abandoned on account of the war, and a few of them are just beginning to come into use again. Walton describes two resorts—Cooper's Well and the Ocean Springs. The Stafford Springs are perhaps the best known in the State at the present time. We have secured the following account from various sources, but chiefly from correspondence with well-known persons in the State :

BELMONT SPRINGS,

(*Formerly Harmon Springs*)

WAYNE COUNTY.

Post-office, Buckatunna. Farmhouse, cottages, and cabins. The Belmont Springs are situated three and one-half miles east of Buckatunna Station, on the line of the Mobile and Ohio R. R., seventy-one miles north of Mobile. Comfortable hacks convey passengers to and from the springs.

This resort, known as the Harmon Springs from 1819 to 1835, was a favorite watering-place for the élite of the Southwest, but during the latter year the buildings were destroyed by fire, and the springs were closed to the public for a long period of time. In recent years, however, they are again attracting attention, and bid fair to recover much of their old-time glory. The location is on a high ridge, about one hundred miles from the Mexican Gulf and at a considerable distance above its level. The surface of the country is of an undulating character, and covered by forests of giant pines. The springs are situated in the valley of Red Creek, a tributary of the Buckatunna, and a clear, swift stream with a rocky and sandy bottom. The springs form natural fountains of clear, sparkling, nearly tasteless water, which seems to issue from great depths. It is very cold and emits a distinctly sulphurous odor. The two principal springs are known as the "Harmon" and the "Lake" springs," although there are many others in the neighborhood. No analysis seems to have been made. The waters have been found useful in disorders of the liver, skin, kidneys, and bowels, and especially in cases of obstinate diarrhœa.

BROWN'S WELLS,

COPIAH COUNTY.

Post-office, Brown's Wells. Hotel and cottages. Access *via* Illinois Central R. R. to Hazelhurst, thence five miles by stage line to springs.

Brown's Wells are situated near the central part of Mississippi, forty miles south of Jackson and one hundred and fifty miles north-east of New Orleans. The location is among the pine hills of

Mississippi, though hickory, oak, and other growths abound. The climate here is very salubrious, and extremes of either heat or cold are seldom observed. The temperature rarely falls lower than 20° F. in the winter or rises above 98° F. in the summer. The elevation above the sea-level is quite considerable. The resort is open for the reception of visitors all the year. Four springs are found in the neighborhood, but only two have been analyzed. Examination of spring No. 1 was made by Prof. John R. Chilton, of New York:

SPRING NO. 1 (BROWN'S WELLS).

Sulphated-saline. Acid-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium sulphate	17.76
Magnesium sulphate	45.00
Calcium sulphate	97.60
Aluminium sulphate	8.11
Iron protosulphate	36.52 (?)
Calcium chloride	16.44
Organic matter	0.92
Free sulphuric acid	40.88 (?)
Total	263.23

This analysis shows a very potent mineral water. It is probable. however, that the chemist's report has been misread in some of the findings, and a new analysis is consequently desirable. According to a quantitative analysis by State Geologist George Little, Spring No. 2 contains:

Calcium carbonate.
Magnesium carbonate.
Sodium carbonate.
Iron sulphate.
Alumina.
Organic matter.
Carbonic acid gas.
Sulphureted hydrogen gas.

The proprietor of the springs, Mr. M. L. Morehead, presents many testimonials from well-known physicians certifying to the value of the waters. They are said to be very useful in rheumatic and gouty disorders, obstinate disturbances of the alimentary tract, functional liver complaints, in dropsical affections due to nephritis, and in anæmia and allied disorders.

CASTALIAN SPRINGS,

HOLMES COUNTY.

Post-office, Durant. Hotel. These springs are located three miles west of Durant, at the point of intersection of the Canton, Aberdeen and Nashville and the main line of the Illinois Central R. R., and about two hundred and fifty miles north of the Gulf coast. There are from ten to twelve passenger trains arriving at and leaving Durant daily, all of which are met by the Castalian Springs stage line.

The country around the springs is generally rolling, with some high hills and beautiful valleys, making a charming combination. The location of the springs is about 300 feet above the sea-level. Notwithstanding the great rainfall in this section, there is very little gloomy or cloudy weather. The clouds roll up quickly, discharge their contents, and disperse, leaving Old Sol to resume his sway. The temperature about the springs ranges, on an average, from 35° F. in winter to 65° F. in summer. The greatest extremes ever noticed are 10° F. the lowest, to 90° F. the highest. The place is used as a resort both summer and winter. At present there are excellent accommodations for about two hundred and fifty persons, but the resort is soon to be improved by the addition of a first-class new hotel with a capacity for 500 guests. The springs are situated in a pleasant little valley shaded by magnificent water-oaks, and surrounded by high hills with gradual slopes to the valley below. The hills are clad with evergreens of pine and some cedar. On the springs property, which embraces some 360 acres, there are about fifty springs and wells, only two of which, however, have been analyzed or used for medicinal purposes. We have been able to secure these analyses, one of which is only a qualitative determination of the mineral ingredients, while the second is a quantitative one :

SPRING NO. 1 (CASTALIAN MINERAL SPRINGS).

(Examination by Prof. E. W. Hilgard, former State Geologist.)

One United States gallon contains 138.5 grains of solid matter, made up of the following ingredients in the order of their quantities :

Calcium sulphate.
Aluminium sulphate.
Magnesium sulphate.
Iron sulphate.
Iron carbonate.
Potassium sulphate.
Sodium chloride.
Silica.

Sulphureted hydrogen gas, strongly charged.
Carbonic acid gas, considerable quantities.

Prof. Hilgard states that the waters may be classed as sulphureted-chalybeate. They possess the astringent qualities of alum water, while at the same time they have laxative properties from the presence of the sulphate of magnesium.

This spring yields about 600 gallons of water per hour, having a temperature of 56° F.:

SPRING NO. 2 (CASTALIAN SPRINGS).

Saline-calcic.

(Prof. L. G. Patterson, present State Chemist, analyst.)

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	37.23
Magnesium sulphate	15.18
Sodium sulphate	8.68

One U. S. gallon contains:

Solids.	Grains.
Silica	7.35
Ferric and aluminium oxide	4.84
Sodium chloride	2.47
Potassium sulphate	1.29
Total	77.04

This spring flows about 300 gallons per hour. The water is used for bathing purposes, and is also sold by the barrel or case. It has long held a wide reputation in Mississippi for the treatment of the malarial cachexia and for liver, stomach, bowel, and skin affections.

COOPER'S WELL,

HINDS COUNTY.

Location, twelve miles east of Jackson (by stage) and four miles from Raymond.

This is one of the famous old-time resorts of Mississippi, and the waters of the well have attracted more attention in days gone by than any others in the State. The well is 107 feet deep and its flow very abundant (Walton). The following analysis was made by Prof. J. Lawrence Smith:

COOPER'S WELL.

Saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	0.61
Calcium sulphate	32.13
Sodium sulphate	11.71
Aluminium sulphate	6.12
Magnesium sulphate	23.28
Sodium chloride	8.36
Calcium chloride	4.32
Magnesium chloride	3.48
Iron peroxide	3.36
Calcium crenate	0.31
Silicon crenate (?)	1.80
Total	95.48

This is a very valuable mild chalybeate water, containing a certain proportion of purgative salts and bearing considerable resemblance to the waters of Bocklet, near Kissingen, in Bavaria. This combination adapts the waters to numerous conditions in which anæmia is associated with constipation or abdominal plethora. Its effects are found to be very satisfactory in dropsy and in chlorosis. In chronic diarrhœa it has long held a high repute. The water acts as a diuretic or aperient according to the quantity used and the mode of drinking.

GODBOLD MINERAL WELL,

PIKE COUNTY.

Post-office, Summit. Hotels and boarding-houses in Summit. Access *via* Illinois Central R. R. to Summit, thence a few minutes' walk to the well.

This well-known chalybeate well is located in the suburbs of Summit, a village one hundred and eight miles northeast of New Orleans and seventy-five miles south of Jackson. The location is 420 feet above tide-water. The well has a depth of eighteen feet and a diameter of four feet. The supply of water is unlimited. The following analysis was made by J. H. Laster, chemist, of New Orleans:

GODBOLD MINERAL WATER.

Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Iron proto-chloride	11.42
Calcium sulphate	Trace.
Sodium chloride	1.73
Calcium carbonate	Trace.
Silica	"
Loss	0.84
Total	13.99

The water is said to possess much value in the treatment of diarrhœa and dysentery and in disorders of the liver and kidneys. It is bottled and sold, but many persons visit the well in person for the purpose of drinking its waters. The water is almost a pure chalybeate, the remaining ingredients being practically inert.

OCEAN SPRINGS,

JACKSON COUNTY.

Post-office, Ocean Springs. Hotels. This is a station on the railroad between New Orleans and Mobile, eighty-three miles east of the former and fifty-seven miles west of the latter. It may also be reached by coast steamers from either city. The name of the springs is derived from their proximity to the gulf, the beach being but half a mile distant. According to Walton, the springs are most resorted to by citizens of New Orleans and Mobile. The analysis was made by Prof. J. Lawrence Smith:

OCEAN SPRINGS.

Saline-chalybeate.

One U. S. gallon contains:

Solids,	Grains.
Sodium chloride	47.77
Potassium chloride	Trace.
Calcium chloride	3.88
Magnesium chloride	4.97

One U. S. gallon contains:

Solids.	Grains.
Ferrous oxide	4.71
Organic matter	Trace.
Ammonia	"
Iodine	"
Total	61.33

Gases.	Cubic inches.
Sulphureted hydrogen	1.28
Carbonic acid	9.79

The water is a potent chalybeate, the iron being no doubt held in solution in the form of a carbonate. The unusual combination of carbonate of iron, chloride of sodium, and sulphureted hydrogen especially adapts it to the treatment of diseases of the skin in persons of a scrofulous diathesis.

STAFFORD MINERAL SPRING,

JASPER COUNTY.

Post-office, Vosburg. Small hotel. Access *via* the "Queen and Crescent" route to Vosburg, thence one and a half miles southeast to spring.

The location is a romantic one, surrounded as it is by Indian mounds and relics, and shaded by graceful and towering gums, sycamores, poplars, and pines. The Choctaws gave the name of Bogohama ("Water of Life") to the spring, hence it is inferred that they used it for medicinal purposes. Its properties have been known to the whites, however, only during the last five or six years. At present there is a large, well-kept boarding-house about one hundred yards from the spring, where guests will find all arrangements for their comfort. It is the intention of the company controlling the spring to build a large and commodious hotel, with all modern conveniences, to accommodate the rapidly increasing number of guests. The many natural advantages of the spot in the way of charming scenery, salubrious climate, and mineral waters will no doubt serve to make it one of the popular spring resorts of the country in the near future. The following analysis of the water was made by Prof. A. L. Metz, of the Tulane University, New Orleans, in 1892:

STAFFORD MINERAL SPRING.

Calcic-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.96
Sodium carbonate	0.41
Potassium sulphate	0.98
Magnesium bicarbonate	0.97
Calcium bicarbonate	13.69
Calcium sulphate	0.56

One U. S. gallon contains:

Solids.	Grains.
Ferrous (iron) bicarbonate	0.24
Alumina	Trace.
Silica	1.99
Organic matter	0.00
Total	19.80

The analysis shows a very good calcic water with ferruginous properties. Its entire absence from organic matter adapts it for table and domestic use. The water has tonic and diuretic properties, and ought to be useful in the diseased or disordered conditions to which this class of waters is applicable. It has been found to render excellent service in Bright's disease of the kidneys and in diabetes, bladder disorders, and other conditions. The water is bottled and sold throughout the United States.

Additional spring resorts of Mississippi:

Chalybeate-acid Springs, near Grenada, Grenada County.

Hazel-Dell Springs, Holly Springs, Marshall County.

Iuka Mineral Springs, Iuka, Tishomingo County; four in number; chalybeate and sulphureted.

La Fayette Springs, La Fayette County; saline and sulphureted.

Quitman Red Sulphur Springs, Quitman, Clarke County; two in number; sulphureted and chalybeate.

Stovall's Springs, Columbia, Marion County; chalybeate.

Winston Springs, Louisville, Winston County.

White's Springs, near Fulton, Itawamba County.

The following are used commercially:

Mount Pleasant Mineral Spring, Mount Pleasant, Marshall County.

Robinson Mineral Spring, Madison County.

There are a number of undeveloped springs in the State.

MISSOURI.

The limits of this State extend from 36° 30′ to 40° 30′ north latitude, and from 89° 2′ to 95° 50′ west longitude. The Missouri River, which bisects the State laterally, divides Missouri into two distinct parts. The surface north of the river is generally level, while that south of it is undulating, becoming rougher and more mountainous as it approaches the Ozark Mountains. The Mississippi and Missouri Rivers, with their numerous tributaries, irrigate and drain every portion of the State. The climate of Missouri is subject to great extremes, the summers in most portions being long and hot, while the winters are very cold. The climate is very salubrious, however, despite these facts, and persons with pulmonary troubles do well in many localities. The mean annual temperature, as observed at St. Louis, is 55° F.; that of the summer 76.12° F., and that of the winter 32.90° F. The average annual rainfall is about 42 inches. The mortality-rate for the State in 1890 was 12.16 per 1000 of population. The mortality from phthisis was at the rate of 1.32 per 1000 of population.

Missouri contains numerous mineral springs, which are of great variety. Many of them have never yet received any attention. As far as known, the springs are very similar to those of the neighboring States, saline, sulphureted, and chalybeate springs predominating. Many of the counties have salt springs or wells, and at one time the production of salt from them was an important industry. We are indebted for the following information to the State and National Geological Reports and to personal investigations. There are no doubt other springs in use in the State, but we have not been able to determine their present status.

AURORA SPRINGS,

MILLER COUNTY.

Post-office, Aurora Springs. Hotels. This resort is located on a spur of the Ozark Mountains, thirty-five miles southeast of Jefferson City. It is reached *via* the Jefferson City, Lebanon and Southwestern R. R.—a branch of the Missouri Pacific system.

The general elevation of this locality is about 1000 feet above the sea-level, and the climate is unsurpassed for healthfulness. That the Ozarks are rich in scenic beauties no one will deny, but only those who have visited them personally can fully sympathize with the sentiment which led Bayard Taylor, the well-known author and traveller, to remark : "I have travelled all over the world to find in the heart of Missouri the most magnificent scenery the human eye ever beheld."

The country may be described as a succession of narrow ravines and well-wooded, high, dividing ridges, running in a general east and west direction, with picturesque streams of clear water winding through and cutting the ridges at right angles, forming narrow gorges, which have, coursing down their sides, sparkling rivulets and saucy brooks, fed by springs located in the hillsides. The Aurora Springs are located under a magnesian limestone formation at the eastern entrance to a charming park and near the headwaters of Saline Creek. The surrounding country slopes gradually to the southeast, and is protected from the winter winds by the higher ground to the north, while the cooler breezes of the summer come from the south and west—down the Osage valley. The principal springs are four in number, known as the "Round," the "Bluff," the "Healing," and the "Bath" Springs. There are a number of others in the locality, including a sulphur spring, located about seven miles further down Saline Creek. The following analysis of the Round Spring was made by Prof. Clifford B. Richardson, analytical chemist, Department of Agriculture, Washington, D. C.:

ROUND SPRING (AURORA SPRINGS, MO.).

Saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	2.42
Magnesium chloride	6.95
Sodium chloride	4.01
Ferrous carbonate	5.13
Ferrous oxide	0.93
Lithia	1.43
Total	20.87

The water is almost a pure chalybeate. It has a sharp tonic effect on the economy, bracing up the digestion, promoting the appetite, and inducing healthful sleep and rest. It has been used with good effect in dyspepsia, renal diseases, rheumatism, scrofulous complaints, and in the debility resulting from nervous affections and uterine complaints.

The town of Aurora is a thriving and enterprising place, having already become the most populous in Miller County. Visitors will find ample hotel accommodations and all facilities for hot, cold, and steam baths.

B. B. MINERAL SPRINGS,

PIKE COUNTY.

Post-office, Bowling Green. Hotels, etc., in Bowling Green. Access *via* Chicago and Alton and St. L. and H. R. R. to Bowling Green.

These springs are two in number. They do not appear to be used extensively as a resort, but their waters are widely sold in the Western States. The following analysis was made in 1887 by Dr. P. Schweitzer, Professor of Chemistry in the Missouri State University:

B. B. MINERAL WATER.

Sulphated-saline. Aluminous.

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	669.47
Sodium sulphate	61.04
Calcium sulphate	80.17
Aluminium sulphate	18.31
Silica	2.66
Lithium chloride	0.29
Total	831.94

This is a very strong water, of the saline-purgative variety, containing, as it does, the sulphates both of magnesia and soda. As a laxative it is recommended in wineglassful doses at bedtime, the stomach being empty. It is said to possess tonic effects when taken in wineglassful doses or less after each meal. When heated and used for bathing it is valuable in rheumatism.

BLUE LICK SPRINGS,

Saline County.

Post-office, Marshall. Cottages at spring. Access *via* Chicago and Alton, or Jefferson City, Boonville and Lexington branch of the Missouri Pacific R. R. to Marshall, thence eight miles by stage south to springs.

Saline County, Missouri, is entitled to eminent distinction as a water-producing district. Thousands of clear springs of more or less volume are well distributed over its surface. They are found in large numbers along the Missouri, Blackwater, and Salt River bluffs, and at the base of the minor hills in all parts of the county, and are unfailing at all periods of the year. The most remarkable natural resources of the county, however, are its mineral waters, which for volume, variety, and medicinal value are among the finest in the country. Not less than 2000 mineral springs, some of them of immense flow, are found in the limits of the county. Some of these springs will no doubt take a prominent place among the health-resorts of the country when they shall have been properly developed. At the Blue Lick Springs are more than thirty distinct fountains in a pretty valley at the base of picturesque wooded bluffs, all within a radius of thirty feet. The foremost of the group, known as the "Gum" Spring, is an immense salt fountain of 57° F., which was formerly the site of extensive salt works, but now the centre of a large bathing establishment. Nearby is the "Blue Lick" Spring, the most important of the group. Then there are numerous black sulphur, magnesian, chalybeate, and sweet springs, besides uncounted saline springs. Many of these have been analyzed by State Chemist Paul Schweitzer, who found in them the following mineral ingredients :

BLUE LICK SPRINGS OF MISSOURI.

Mineral Ingredients.

Sodium chloride.
Potassium chloride.
Calcium chloride.
Magnesium chloride.
Lithium chloride.
Calcium carbonate.
Iron carbonate.
Magnesium carbonate.
Manganese carbonate.
Magnesium bromide.
Magnesium iodide
Magnesium sulphate.
Potassium sulphate.
Calcium sulphate.
Barium sulphate.
Calcium sulphite.
Sodium sulphite.
Ammonium nitrate.
Magnesium nitrate.
Calcium phosphate.
Alumina.
Silica.
Sulphur.

Carbonic acid gas, large quantities.
Sulphureted hydrogen gas, large quantities.

Many of these ingredients serve to endow the waters with valuable remedial qualities. A complete qualitative analysis of the Blue Lick Spring, for which the collection is named, resulted as follows:

BLUE LICK SPRING.

Muriated and Sulphated-saline. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	57.84
Magnesium sulphate	26.13
Magnesium chloride	10.94
Sodium chloride	493.88
Potassium chloride	0.64
Silica	8.16
Alumina	10.23
Organic matter	2.48
Total	610.30

Gases.	Cubic inches.
Free carbonic acid	53.22
Sulphureted hydrogen	Not estimated.

It will be seen that the waters are very similar to those of the Blue Lick Springs of Kentucky, for which these springs were named.

The water is well adapted for the treatment of constipation, especially when due to engorgement of the portal system. On the other hand, it is also said to act beneficially in many cases of chronic diarrhœa. It acts with advantage in many of the conditions due to a sluggish liver, such as hemorrhoids, jaundice, etc. Being a very efficient diuretic, the water is useful in certain renal and bladder disorders. Within sixty steps of the Blue Lick Spring are three black sulphur springs; two hundred and fifty yards south is the Sweet Spring, which has been found to be a very efficient diaphoretic and diuretic. It is entirely free from sulphur, and forms an exceedingly pleasant beverage.

CLIMAX SPRINGS,

CAMDEN COUNTY.

Post-office, Climax. Hotel. Access *via* Missouri Pacific R. R. to Warsaw, thence twenty-five miles by stage to springs.

These springs are seven in number, and are located in a rolling, heavily timbered region, with many pleasing landscapes. An analysis of the waters was made in 1882 by Prof. N. W. Wiley, of Purdue University, Indiana, State chemist:

CLIMAX SPRINGS.

Iodo-bromated.

One U. S. gallon contains:

Solids.	Grains.
Calcium oxide	4.98
Magnesium oxide	1.80
Aluminium oxide (with iron oxide)	5.08
Sulphuric acid	3.60
Carbonic acid	3.92
Sodium[1]	14.00
Potassium[1]	1.20
Iodine,[1] Bromine,[1]	14.00
Chlorine[1]	20.40
Loss	3.02
Total	72.00

This water is remarkable for the quantity of iodine and bromine which it contains. They are somewhat similar to the waters of the celebrated Kreutznach Springs, of Prussia, but are far stronger in these ingredients. Such waters are especially adapted for the treatment of chronic syphilitic and scrofulous affections. The analysis is obviously incomplete, however, and a new examination should be made. We have been unable to obtain a recent report of these springs. The foregoing account is compiled from Walton's work and from the United States Geological Reports.

EXCELSIOR SPRINGS,

CLAY COUNTY.

Post-office, Viginti. Hotels. Access *via* St. Joseph branch of the Wabash, St. Louis and Pacific R. R. to Vibbard; thence five miles by stage to springs.

These springs are four in number. They do not appear ever to have had a quantitative analysis. They are known to contain about 25 grains of solid matter to the United States gallon, composed of the following ingredients:

Calcium chloride.
Magnesium chloride.
Sodium chloride.
Calcium carbonate.
Magnesium carbonate.
Sodium carbonate.
Iron.
Alumina.
Silica.

The water has been used with benefit in liver, kidney, and bladder troubles. The springs are located in a delightful valley, two or three miles in area, surrounded by rugged hills. The locality is very healthy.

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[1] Doubtless in combination.

HAGGENBUSH SPRINGS,

TEXAS COUNTY.

Post-office, Cabool. Access *via* Kansas City, Springfield and Memphis R. R. to Cabool; thence half a mile to springs.

The springs are three in number, and are supposed to possess valuable medicinal properties; but we are informed by Mr. Lee Haggenbush, on whose farm they are located, that no analysis has yet been made. The place is said to offer a fine location for a sanitarium.

LAKE PARK WHITE SULPHUR SPRINGS,

VERNON COUNTY.

Post-office, Nevada. Hotels. Nevada is a flourishing and beautiful little city, located in western Missouri, one hundred miles south of Kansas City. It is accessible by three railroads, viz., the Missouri, Kansas and Texas, the Missouri Pacific, and the Nevada and Minden R. R. Lake Park, in which the springs are located, is a pleasing spot one mile out from the city, and reached by horse-cars, which run every twenty minutes. The three principal springs are known as the "White Sulphur," the "Iron," and the "Clear Water" Springs. No analysis seems to have been made, but the springs are beginning to attract considerable attention on account of their medicinal properties. The park is about one hundred and thirty acres in extent, and, besides the springs, contains two lakes which afford abundant opportunities for boating, bathing, fishing, etc.

LOTUS SPRINGS,

DADE COUNTY.

Post-office, Greenfield. Hotel. These springs are four in number, and are situated about six miles east of Greenfield, the county seat of Dade County, and two miles from the Gulf Railroad Station, at Pilgrim.

The location is in the Ozark Mountains, and about 1400 feet above the sea-level. The springs yield about 2000 gallons of water per day of twenty-four hours. A qualitative analysis at the School of Mines, at Rolla, showed the presence of salts of calcium, magnesium, sodium, potassium, and iron, together with carbonic, sulphuric, and silicic acids, probably in combination. The water is said to have been found useful in gastric and renal disorders.

MONTESANO SPRINGS,

JEFFERSON COUNTY.

Post-office, Sulphur Springs Landing. Hotel. Access from St. Louis *via* St. Louis and Iron Mountain R. R., twenty miles south; also by steamers on the Mississippi River.

The springs are located in a broken but picturesque region, about 600 feet above the sea-level. They are twelve in number. The flow of water is estimated at from 1500 to 3000 gallons per hour. The following analyses of the two principal springs were made by Messrs. Potter and Riggs, of the Washington University:

MONTESANO SPRINGS.

Muriated saline, sodic, magnesic, and calcic.

One U. S. gallon contains:	Montesano Spring.	Casco Spring.
Solids.	Grains.	Grains.
Calcium carbonate	71.45	69.97
Magnesium carbonate	14.05	15.50
Calcium sulphate	32.37	33.93
Iron and alumina	0.87	0.75
Sodium hyposulphite	0.74	0.65
Calcium phosphate	Trace.	Trace.
Sodium sulphide	0.34	0.43
Sodium chloride	365.11	368.21
Potassium chloride	16.37	16.99
Magnesium chloride	35.91	34.41
Magnesium bromide	Trace.	0.11
Magnesium iodide	0.85	...
Silica	0.51	0.67
Total	538.57	541.62
Gases.	Cubic inches.	Cubic inches.
Carbonic acid	46.43	43.20
Sulphureted hydrogen	1.40	1.60

Other springs at Montesano are the "Council," "Alton," "Pearl," and "Thorne" Springs.

The waters are laxative, and also possess alterative properties. Their continued use in small doses produces favorable results in cases of chronic constipation and dyspepsia, and in disorders of the blood, liver, and kidneys. The accommodations for visitors are limited as yet, consisting of a small hotel and a few private houses where boarders are taken. The water is shipped from the springs in pint, quart, and half-gallon bottles. A peculiar creamy substance, the natural product of one of the springs, is also used commercially. It has not been analyzed, but is said to be highly efficacious as a local application to old sores, ulcers, or raw surfaces of any kind.

PARIS CHALYBEATE SPRINGS,

LAWRENCE COUNTY.

Post-office, Paris Springs. Hotel and cottages. Access *via* Kansas City, Fort Scott and Gulf R. R. to Ash Grove; thence ten miles by stage to springs. The springs are delightfully located in the Ozark Mountains, the surrounding country being interspersed with beautiful glens, green meadows, dense forests, and orchards. The elevation (1500 feet above the sea-level) is sufficient to assure freedom from depressing heat in the summer time. The spring yields about 120 gallons of water per hour, having a temperature of 52° F. A qualitative examination showed the presence of oxide of iron in solution, besides the carbonates of lime and magnesia, the chlorides of sodium, potassium, and iodine. A complete qualitative analysis is desirable. Patients suffering from disorders of liver, kidneys, stomach, skin, and nervous system have found great benefit from a sojourn at the springs. The tonic properties of the water have been well shown in the debility of anæmia and various disorders of the female sexual system.

SWEET SPRINGS,

SALINE COUNTY.

Post-office, Brownsville. Hotel. Access *via* Sedalia and Lexington branch of the Missouri Pacific R. R. to Brownsville; thence one mile to springs. The location is fifteen miles from the Missouri Blue Lick Springs.

These springs are five in number, and have a flow of 224,000 gallons hourly. The temperature of the water is 54° F. Analyses of two of the springs have been made by Prof. Charles P. Williams :

SWEET SPRINGS.

Muriated saline-calcic.

One U. S. gallon contains : Solids.	Akesion Spring. Grains.	Sweet Spring. Grains.
Calcium carbonate	40.25	9.56
Iron carbonate	0.27	0.57
Manganese carbonate	0.20	Trace.
Sodium sulphate	2.61	. . .
Calcium sulphate	57.93	9.46
Barium sulphate	8.15	. . .
Calcium phosphate	0.24	. . .
Magnesium nitrate	0.18	. . .
Ammonium nitrate	1.17	. . .
Sodium chloride	756.11	86.92
Calcium chloride	74.79	14.72
Potassium chloride	28.56	3.40
Magnesium chloride	87.32	22.29
Lithium chloride	0.30	0.05
Magnesium bromide	0.13	0.12
Aluminium oxide	0.17	0.09
Silica	0.51	1.08
Organic matter	3.05	4.01
Total	1061.94	152.27

It will be observed that there is a great difference in the strength of these waters, the Akesion Spring being much more potent. The spring also contains a considerable amount of sulphureted hdyrogen. It is especially recommended for diseases of the liver. The water of the Sweet Spring is recommended for diseases of the kidneys and bladder. An excellent bathing establishment is maintained at the springs, baths being supplied by water from the salt-sulphur spring, five miles distant. There are also white and black sulphur springs in the neighborhood.

Additional Missouri springs used as resorts :

Blankenship's Medical Springs, near Houston, Texas County; one hundred in number; flow, 2000 gallons per hour.

Bowsher Mineral Spring, near Princeton, Mercer County.

Cedar Springs, Cedar County; chalybeate.

Colis Springs, Malta Bend, Saline County; supposed to be chalybeate (unimproved up to May, 1894).

Dixon Springs, Cureall, Howell County; fifty in number; 1300 gallons hourly.

Eldorado Springs, Cedar County; three in number; 180 gallons hourly.

Eldorado Springs, Oregon County; fifty in number; chalybeate.

Fairview Mineral Spring, Denver, Worth County; chalybeate and saline.

Harriman's Sulphur Spring, Cooper County.

Indian Springs, McDonald County.

Landreth's Mineral Well, Knox City, Knox County; saline-chalybeate.

Louis Spring, Greenfield, Dade County.

Mineral Springs, Panacea, Barry County.

Moorsville Mineral Springs, Livingston County; calcic; saline.

Randolph Medical Springs, Randolph County.

Reiger Spring, Mercer County.

Rocheport Sulphur Springs (or Adams Springs). Rocheport, Boone County; four in number; sulpho-saline.

Siloam Springs, Siloam Springs, Howell County; fifteen in number; alkaline-saline.

Spaulding Springs, Ralls County; four in number; saline-chalybeate.

Zodiac Springs, Vernon County; twelve in number; saline-chalybeate.

MONTANA.

This State extends from 104° to 116° west longitude, and from 44° 25′ to 49° north latitude. The western portion of the State is mountainous and the eastern is a vast, rolling table-land. The principal range of the Rocky Mountains extends along the south-western boundary of the State, and the scenery in many parts is grand and impressive. Besides the two great rivers—the Missouri and the Columbia—which have their sources in Montana, there are a number of other noble streams in the State, notably the Yellowstone, Jefferson, Madison, Musselshell, Gallatin, and Deer Lodge Rivers. The climate is milder than the latitude and elevation would seem to indicate, the mean annual temperature as observed at Helena being 43.04° F.; that of the summer 70.28° F., and of the winter 19.16° F. The mortality-rate, as computed from the last United States census, was 7.66 per 1000 of population. The death-rate from consumption was 0.42 per 1000.

The mineral springs of Montana are numerous and important, although but little has ever been written concerning them. Walton describes but one locality—the White Sulphur Springs, and Bell's book dismisses the subject with the mere statement that these springs exist, but had not at that time (1885) been improved. Owing to the scantiness of the population, many valuable springs in the State are still in an undeveloped condition. Many of the Montana springs are thermal, especially in the western portion of the State. We find here all the conditions usually existing in connection with hot springs, viz., volcanic rocks, uplifted mountain chains, and dislocations or fractures of the strata. There are, however, a number of very excellent cold springs in the State. We have secured the following information chiefly by means of personal inquiry in all parts of the State.

ALHAMBRA SPRINGS,

JEFFERSON COUNTY.

Post-office, Alhambra. Hotel. Access by Northern Pacific or the Great Northern R. R. The location is fifteen miles from Helena. The springs are situated at a level of 3786 feet above the sea, the surrounding country being broken and mountainous. The atmosphere in this region is very dry, with but little rain in the summer or snow in the winter. The scenery is varied and picturesque, the hills and mountains being covered by different varieties of pine, fir, cypress, etc., and the bottoms dotted with groves of alder, willow, mountain ash, poplar, and other trees. Many varieties of plants have been found in the neighborhood, which, it is said, have never yet been classified. The springs are situated in an angle formed by the junction of two creeks in which mountain trout abound. Game is still quite abundant, consisting of grouse, pheasants, deer, elks, mountain lions, and a few bisons. The springs are twenty-two in number, and vary in temperature from 90° F. to 134° F. A complete analysis has never been made, but Dr. G. W. Stein, the proprietor, sends us the following partial qualitative analysis by himself:

Sodium carbonate.
Potassium carbonate.
Calcium carbonate.
Lithium carbonate.
Sodium chloride.
Potassium sulphate.

One spring is said to be strongly chalybeate, while another is heavily impregnated with fluoride of calcium.

A sufficient quantity of the waters of some of the springs produces mild purgative effects with most people. Dr. Stein states that the internal use of the waters is markedly advantageous in cases of chronic articular rheumatism and other disorders for which the Carslbad waters of Bohemia have become famous. Mild attacks of albuminuria usually disappear, and even advanced cases of Bright's disease are benefited. Abundant hot and cold water bathing facilities, with a plunge and swimming bath, are provided.

BOULDER HOT SPRINGS,

JEFFERSON COUNTY.

Post-office, Boulder. Hotel and cottages. These springs are located within two miles of the town of Boulder, about midway between Butte and Helena. They are reached by both the Northern Pacific and Great Northern R. R. The springs are numerous, and some of them have a large outflow of water. The surrounding country is of a rugged, mountainous character, the location of the springs being 4904 feet above the sea-level. The following analysis, supplied by Mr. George B. Beckwith, manager of the springs, was made at the Columbia School of Mines, New York City:

BOULDER HOT SPRINGS.

Saline-chalybeate. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	4.70
Sodium sulphate	4.30
Sodium carbonate	2.60
Calcium carbonate	1.30
Magnesium carbonate	3.60
Sulphur	4.80
Iron	2.90
Total	24.20

The temperature ranges from 125° F. to 187° F. The water is said to be very palatable as a beverage. The hotel is heated by the water of the springs, and bathing facilities are abundant. The diseases especially benefited here are rheumatism, indigestion, chronic constipation, renal, cutaneous, and hepatic diseases, and metallic poisoning.

FERRIS HOT SPRINGS,

(*Formerly Matthews*)

GALLATIN COUNTY.

Post-office, Bozeman. Hotel. These springs are located on the east bank of the West Gallatin River, seven miles west of Bozeman, from which place they are reached by coach. They were discovered over twenty years ago, but were not much improved until quite recently. The present proprietor has erected a handsome modern hotel, improved the natural charming surroundings, and placed the resort on a par with the most attractive in the West. The location of the hotel possesses unusual advantages. To the north, east, and south a broad expanse of level country stretches out, dotted here and there by groves of cottonwood and poplars, the intervening ground being occupied by fields of growing grain and verdant meadow-lands. On the west the river sweeps along in magnificent curves, the line of tall trees conforming to the meanderings of the stream. Back of all, the grand old Rockies—snow-crowned, rock-ribbed, majestic—form an apparently unbroken guard to the enchanting scene which lies in tranquil loveliness below. The location is 4500 feet above the sea-level. Fish and game are found in great abundance and variety in the neighborhood. An analysis of the waters by Messrs. Riggs and Clark, of the United States Geological Survey, in 1885, resulted as follows:

FERRIS HOT SPRINGS.

Saline-silicious.

One U. S. gallon contains:

Solids.	Grains.
Silica	4.61
Sodium silicate	6.40
Calcium carbonate	2.28
Magnesium carbonate	0.21
Sodium carbonate	4.37
Potassium chloride	0.78
Sodium chloride	4.12
Sodium sulphate	11.51
Loss	0.06
Total	34.34

The analysis shows sufficient sulphate of soda to give the waters a laxative effect when taken in considerable quantities. They are useful both for internal use and for bathing in the diseased conditions to which hot saline waters are applicable.

HUNTER'S HOT SPRINGS,

GALLATIN COUNTY.

Post-office, Springdale. Hotel and sanitarium. Access *via* Northern Pacific R. R. to Springdale, where stages connect with the springs, three miles distant, the road crossing a magnificent iron bridge on the Yellowstone River. Hunter's Springs are situated at the base of the foothills of what is known as the Crazy Range of mountains. The location is 1000 miles west of St. Paul and 920 miles east of Portland, Oregon, and has an altitude of 4480 feet above the sea-level. The surrounding scenery is of the grand and romantic character commonly found in the Rocky Mountains. The climate is dry and salubrious, and severe storms are unknown. The thermometer seldom reaches as high as 98° F. in summer or as low as zero in winter. The springs boil up from a rocky ledge in the bottom of a little valley or basin enclosed by gently undulating hills. They are twenty-seven in number, and are arranged in three principal groups, varying in heat from 148° F. to 168° F., with a combined outpour of about 90,000 gallons per hour. The water is clear and sparkling and remarkably soft. At present only the waters from the upper springs are used for the baths of the sanitarium. The baths for ladies and gentlemen are in separate buildings, each fitted with a plunge, tub, and vapor baths, and heated by the hot waters. About eighty rods from the bath-house is an outdoor summer bath, about one hundred and five feet square and from four to six feet deep, supplied with water from the lower group. This is said to be the largest bath of hot mineral water in the United States. The sanitarium connected with the springs has recently been enlarged and is adequately prepared for the reception of various classes of patients. Cases of rheumatism, liver disorders, bronchial catarrh, asthma, gout, and uterine diseases have been benefited or cured by a sojourn at this resort and the use of the waters and baths. An analysis by Prof. Noyes, of the Minnesota State University, resulted as follows :

HUNTER'S HOT SPRINGS.

Light Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Silica	4.52
Alumina	0.07
Iron carbonate	Trace.
Calcium carbonate	0.23
Magnesium carbonate	Trace.
Lithium carbonate	"
Potassium carbonate	0.32
Potassium iodide	Trace.
Potassium bromide	"
Sodium chloride	1.44
Sodium sulphide	0.85
Sodium sulphate	0.61
Sodium phosphate	Trace.
Sodium biborate	"
Sodium carbonate	8.79
Ammonium (free)	0.02
Albuminous ammonia	Trace.
Total	16.85

LISSNER'S MINERAL SPRING,

LEWIS AND CLARKE COUNTY.

Post-office, Helena. Hotels. This spring is located in Helena, about three hundred yards from the International Hotel, at the corner of Main and State Streets. The spring gushes from the foot of a granite mountain, three hundred feet high, at the rate of about 20,000 gallons a day. A qualitative analysis by Messrs. Thomas Price & Son, chemists, of San Francisco, showed the presence of the chlorides, carbonates, and sulphates of lime, magnesia, soda, and potash. It is free organic or vegetable matter. The water is used commercially, and is recommended for indigestion, constipation, liver, kidney, and bladder troubles. We are unable to classify the water in the absence of a complete quantitative analysis.

PULLER SPRINGS,

MADISON COUNTY.

Post-office, Puller Springs. Hotel. This resort is reached by a good wagon-road, and has semi-weekly mails.

The location is in a beautiful valley, having an elevation of 5530 feet above the sea-level. The springs are two in number, the temperature being 95° F. for the larger and 105° F. for the smaller spring. No analysis. The waters have been found beneficial in rheumatism and allied disorders.

WHITE SULPHUR SPRINGS,

MEAGHER COUNTY.

Post-office, White Sulphur Springs. Hotel. Access by Northern Pacific R. R. to Townsend; thence by stage or private conveyance to springs. They may also be reached by stage from Helena, seventy-five miles distant. The springs are located at an elevation of 5012 feet above the sea-level, in a valley seventy-five miles long by ten or fifteen wide, watered by numerous streams where trout and other fish are abundant. Game is also plentiful in the surrounding mountains.

An analysis by R. B. Riggs, of the United States Geological Survey, in 1885, showed the presence of the carbonates of sodium, calcium, and magnesium, sulphate of sodium, chlorides of sodium and potassium, silica, and a trace of sulphureted hydrogen. The water is of the alkaline-saline-thermal type. The temperature of the water varies from 95° F. to 125° F. It is recommended for the liver, and skin diseases and syphilis.

The following springs of Montana are more or less used as resorts:

Allan's Mineral Springs, Pine Creek, Bitter Root Valley, Missoula County.

Clark's Warm Springs, near Pony, Madison County.

Helena Hot Springs, near Helena, Lewis and Clarke County.

NEBRASKA.

Nebraska extends from 40° to 43° north latitude, and from 95° 13′ to 104° west longitude. The greater part of the State is a plateau. The eastern half has an average elevation above the sea-level of 1400 feet. The average elevation of the whole State is 2312 feet. There are no mountains, but in the northern and western parts there are some ridges and a few lofty hills. Not less than 25 per cent. of the entire surface is composed of well-watered valleys. There are a great number of ponds and lakelets. The principal rivers are the Missouri, which forms part of the northern and all of the eastern boundary; the Niobrara, and the Nebraska or Platte. Owing to the elevation above the sea, the dryness of the atmosphere, and the great amount of ozone which it contains, and the fine natural drainage of the State, the climate is exceptionally healthy, especially for persons of consumptive tendency. The diseases incident to the climate are rheumatism, neuralgia, and, in isolated spots, malaria. The mean annual temperature, as observed at Omaha, is 49.28° F.; that of summer 74.26° F., and that of winter 23.36° F. The mortality-rate in 1890 was 7.99 per 1000 of population; phthisical death-rate 0.57 per 1000.

The mineral springs of Nebraska are few in number, and, so far, unimportant. No work on mineral springs mentions any resorts in the State, and the list of the United States Geological Survey contains but three spring localities, none of them being in use. In many places the waters reached by wells are no doubt mineralized to some extent, as in the adjoining States of Kansas and South Dakota. Saline springs are found in the southeastern part of the State and also along the Elkhorn and Loup Rivers. We have made a personal visit to the State and have directed inquiries to a number of localities, but have secured information of only one spring resort, which probably represents the State's entire contribution up to the present time.

VICTORIA MINERAL SPRINGS,

CUSTER COUNTY.

Post-office, New Helena. Hotel built recently. New Helena is reached by the Burlington and Missouri R. R.

The springs are seven in number, and are at a level of 2600 feet above tide-water, in a level prairie country having fine roads. It is said that an average of 350 clear, sunny days in the year may be counted upon in this region. The accommodations for visitors are limited at present, but improvements are at this time being added. The springs were discovered in 1888, and it is stated that no two of them are exactly alike. The largest, known as the "Magnesia" Spring, is used for bottling. Each spring has a different flow, yielding from 1200 to 3000 gallons per hour. An analysis, made in 1888, resulted as follows. We are unable to secure the name of the analyst :

MAGNESIA SPRING (VICTORIA MINERAL SPRINGS).

Alkaline-saline-calcic.

One U. S. gallon contains : Solids.	Grains.
Calcium carbonate	15.63
Magnesium carbonate	11.27
Iron carbonate	0.08
Sodium sulphate	2.16
Calcium sulphate	18.03
Magnesium sulphate	12.06
Potassium sulphate	1.46
Ammonium sulphate	0.23
Sodium chloride	1.26
Lithia	Trace.
Iodine	"
Bromine	"
Total	62.18

The water has an unvarying temperature of 55° F. It is coming into considerable use as a commercial water, and in addition to table and domestic use it is recommended for stomach and kidney disorders.

An artesian well, in Lincoln, Lancaster County, is said to yield a valuable saline water. Another spring of the State, mentioned in the United States Geological Reports, is the Saratoga Sulphur Spring, Saratoga, Holt County. It has not come into use, so far as can be learned.

NEVADA.

Nevada extends from 114° to 120° west longitude, and from 35° to 42° north latitude. The surface of the State is an elevated tableland, with an average height of over 4000 feet above the sea-level, broken into by several ranges of mountains running from north to south. The Sierra Nevada Mountains form a part of the western boundary, and vary from 7000 to 13,000 feet in height. The principal rivers are the Colorado and the Humboldt. Other smaller streams are the Truckee, Walker, Carson, and Quinn's Rivers. The mountains are generally covered from base to summit with a growth of forests, consisting of pine, spruce, and fir. The hardier fruits, berries, etc., grow luxuriantly. The series of long, narrow basins, surrounded by rugged, steep, and, in many places, lofty mountains, present a weird grandeur of scenery surpassed by none other in the United States. The climate is generally mild and healthful and the air dry and invigorating. The rainfall is scanty, occurring, as a rule, only in the spring. The mean annual temperature is 54.13° F.; that of the summer 75.18° F., and of the winter 34.55° F. The death-rate, according to the United States census of 1890, is 9.48 per 1000; phthisical mortality-rate, 0.77 per 1000 of population. The State is plentifully supplied with mineral springs of great variety; but such is the scantiness of the population and the extent of the territory that few of them have become well known and only a small proportion developed in any way. None are mentioned as resorts in any of the books on mineral springs. West of Palisade and south of the Union Pacific R. R. is a region that contains numerous intermittent hot springs whose waters are impregnated with sulphur. These springs are usually found in connection with fractures of the strata or geological fault-lines. Salt and borax springs are also numerous. There are a number of fumaroles and geysers in the State, notably in the Volcanic Springs district, in Lander County, near Beowawe. These springs have not come into use as a resort, nor has the Pueblo Hot Springs in Humboldt, mentioned by Walton.

By assiduous correspondence and personal inquiry we have been able to elicit direct information from a single spring locality in the State at this time used as a resort.

WALLEY'S HOT SPRINGS,

DOUGLAS COUNTY.

Post-office, Genoa. Hotel. This resort, formerly known as Genoa Hot Springs, is located about fourteen miles from Carson City, the capital of the State. The situation is picturesque, having an altitude of about 4000 feet, with high mountains on the west and a beautiful valley on the east. The prevailing weather is clear and pleasant, the temperature seldom exceeding 90° F. in summer or falling below zero in winter. Mr. H. J. Walley furnishes us with the following analysis made by J. W. Phillips, analytical chemist at the Nevada Agricultural Experimental Station:

WALLEY'S HOT SPRINGS.

Sulphated-saline.

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	0.67
Sodium sulphate	12.41
Iron sulphate	Trace.
Calcium sulphate	2.19
Sodium hyposulphite	0.40
Sodium bicarbonate	0.64
Magnesium bicarbonate	Trace.
Sodium biborate	1.45
Sodium chloride	4.78

One U. S. gallon contains:

Solids.	Grains.
Silica	2.85
Alumina	0.02
Ammonia	Trace.
Organic matter	“
Total	25.41

Carbonic acid gas, 6.48 cubic inches.

The temperature of the several springs (six in number) varies from 136° F. to 160° F. The baths here are stated to be very efficacious in the treatment of renal and skin diseases and in rheumatism of long standing. The analysis shows a valuable thermal water of the saline class.

According to the United States Geological Reports, the following springs of Nevada have been used as resorts either by the aborigines or the white settlers:

Elko Hot Springs, Elko, Elko County.

Golconda Hot Springs, Golconda, Humboldt County.

Mineral Spring, one mile east of Carson City, Ormsby County; thermal.

Thermal Springs, ten miles north of Wellington, Lyon County.

Kyle's Hot Springs, twelve or fifteen miles east of Star Peak, Humboldt County.

Mineral Hill Hot White Sulphur Springs, near Mineral Hill, Elko County.

These springs are five in number, and are said to have a boiling temperature.

Shaw's Hot Springs (formerly Swift's), two miles northeast of Carson City, Ormsby County; temperature 120° F.

Steamboat Springs, Steamboat Springs, Washoe County; temperature 204° F.

Sulphur Springs, in Sodaville, north of Columbus, Esmeralda County.

Whelan's White Sulphur and Mineral Springs, Pine Valley, Eureka County.

NEW HAMPSHIRE.

The limits of New Hampshire extend from 42° 41′ to 45° 11′ north latitude, and from 70° 40′ to 72° 28′ west longitude. The Atlantic border of the State is a sandy beach, succeeded inland by hills which increase with considerable rapidity in elevation. The region of hills is quickly followed by that of the mountains. Taken as a whole, the natural features of New Hampshire are bold, prominent, and in some localities sublime; and its elevated regions are often called the Switzerland of America. Some of the peaks of the White Mountains are upward of 6200 feet above the Atlantic Ocean, Mount Washington and Mount Lafayette being the highest. There are several important lakes, the largest being Winnipiseogee, Squam, and Sunapee. The principal rivers are the Connecticut, Androscoggin, and Merrimac, all of which have their origin in New Hampshire. The State is much visited during the summer months by tourists in quest of recreation and pleasure amid the lake and mountain scenery. The climate is healthful, and epidemics are unknown. The winters, however, are long and cold, and the summers are frequently hot. Among the attractive localities in the White Mountain region are Alton Bay, Wolfborough, and Center Harbor, on Lake Winnipiseogee; Plymouth, Sandwich, and Campton, south of the mountain region; Bethlehem, Jefferson, Gorham, and Lancaster, north and west of it; North Conway, east of it. The death-rate in 1890 was 18.79 per 1000 of population; the phthisical mortality-rate was 1.93 per 1000.

There are a considerable number of mineral springs in New Hampshire, but, with one or two exceptions, none of them appear to be used to any great extent. The waters of the commercial springs, however, have a very large sale, their value, according to the United States Geological Reports of 1896, being greater than that of the waters of any other State for the preceding year, 1895. From various sources, chiefly from geological reports, we have obtained information of the existence of thirteen localities. Walton mentions three springs in the State; Pepper's list nine, and Peale eleven. The springs, as a rule, are not highly mineralized, resembling in this respect those of other New England States.

BIRCHDALE SPRINGS,

MERRIMAC COUNTY.

Post-office, Concord. Hotel. These springs are located about four miles from the State House.

The springs are four in number, known as the "Concord," "Merrimac," "Granite," and "Penacook." The following analysis of the Concord Spring was made in 1873 by Prof. Charles F. Chandler, of New York:

BIRCHDALE SPRINGS (THE CONCORD SPRING).

Calcic-chalybeate.

One U. S. gallon[1] contains:

Solids.	Grains.
Sodium bicarbonate	0.19
Calcium bicarbonate	2.09
Magnesium bicarbonate	0.84
Iron bicarbonate	0.37
Sodium chloride	0.38
Sodium sulphate	0.26

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[1] The original analysis was estimated in grains per imperial gallon.

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	0.07
Sodium phosphate	0.01
Silica	0.92
Alumina	0.12
Organic matter	0.67
Total	5.92

We have been unable to obtain information relating to the present status of these springs. They were formerly used both commercially and as a resort.

BRADFORD MINERAL SPRING,

MERRIMAC COUNTY.

Post-office, East Washington. Hotel. Access from Boston *via* the Lowell R. R. to East Washington; thence one mile to hotel at springs. Stages await trains during the season from May 15th to October 15th.

This spring became known to the white settlers in 1770, and since early in the present century its waters have been used for medicinal purposes. An analysis by Dr. Jackson, of Boston, subsequently confirmed by Dr. Richards, of Poughkeepsie, New York, showed the presence of the following ingredients :

BRADFORD MINERAL SPRING.

Qualitative Analysis.

Sodium chloride.
Potassium chloride.
Sodium carbonate.
Calcium carbonate.
Magnesium carbonate.
Carbonic acid gas.
Calcium sulphate.
Iron oxide.
Aluminium oxide.
Organic matter.
Sulphur.

We are unable from this analysis to assign the water to its proper class, although it is probably a sulphureted chalybeate. The spring yields 2100 gallons hourly. The water is clear and sparkling, and emits an odor of sulphureted hydrogen gas. It has been successfully used by the residents of the neighborhood in the treatment of certain cutaneous diseases, especially eczema. It is said to be a very efficient diuretic and tonic, and seems to be well adapted for rheumatism and diseases of the alimentary tract, and for conditions in which the urine is scanty and high-colored. As a douche in nasal catarrh and in catarrhal states of the vagina and uterus it has been found useful. There are bathing facilities for guests who wish to take hot or cold sulphur baths. The surroundings of the place are very attractive, and ample amusements and diversion are afforded the visitor in the way of bowling, shooting, fishing, driving, etc.

LONDONDERRY LITHIA SPRING,

Rockingham County.

Location, Londonderry. This spring is evidently not used as a resort, but its waters have become widely celebrated and are extensively sold. The following analysis was made by Prof. H. Halvorson :

LONDONDERRY LITHIA WATER.

Alkaline-chalybeate. Lithiated and aluminous.

One U. S. gallon[1] contains:

Solids.	Grains.
Calcium sulphate	25.13
Potassium carbonate	18.33
Calcium bicarbonate	7.29
Magnesium carbonate	7.53
Aluminium sulphate	5.05
Lithium bicarbonate	7.29
Iron carbonate	1.85
Potassium sulphate	0.30
Sodium chloride	0.83
Silica	1.25
Organic matter	None.
Total	74.85

Carbonic acid gas, 62.84 cubic inches.

The analysis shows a very potent and valuable mineral water, possessing the virtues of an antacid, diuretic, and ferruginous tonic. It has been found beneficial in a wide range of diseases, but notably those due to the uric-acid diathesis. The best effects of the water have been observed in gout, rheumatism, in neuralgic pains, in gravel, and in giddiness, headache, insomnia, and other manifestations denoting the lithæmic state. Being entirely free from organic matter, the water is well adapted for domestic use. Although not used as a resort, the proprietors of the spring extend a welcome to visitors and are pleased to show them through their extensive bottling plant (at Nashua).

The following-named springs of New Hampshire are mentioned in the Geological Reports of the State :

Abenaquis Spring, Walpole, Cheshire County.

Amherst Soda Springs, two miles from Amherst, Hillsboro County; has been used as a resort.

Charleston Springs, Charleston, Sullivan County; unimportant.

Milford or Ponemah Springs, Milford, Hillsboro County; four in number; chalybeate, etc.; has been used commercially and as a resort.

Moultonborough Mineral Spring, Moultonborough, Carroll County; formerly used as a resort.

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[1] The original analysis was estimated in grains per imperial gallon.

Sulpho-chalybeate Spring, near Pittsfield, Merrimac County.

Unity or Unitoga Springs, East Unity, Sullivan County; ten in number; alkaline-calcic; resort.

White Mountain Mineral Spring, Conway, Carroll County; alkaline; has been used as a resort.

Yocum Spring, Goffstown Center, Hillsboro County; chalybeate; has been a resort; present status not known.

The following are used commercially:

Amherst Mineral Spring, Amherst, Hillsboro County.

Pack Monadnock Lithia Spring, Temple, Hillsboro County.

NEW JERSEY.

New Jersey extends from 38° 56′ to 41° 30′ north latitude, and from 73° 55′ to 75° 32′ west longitude. The northern portion of the State is hilly and mountainous, the highest elevations reaching from 1000 to 1750 feet. The Palisades, a wall of perpendicular trap-rock from 300 to 600 feet high, form the western bank of the Hudson River for fifteen miles. The central portion of the State is a rolling country, and the eastern portion a sandy plain, declining to the sea. The Atlantic coast-line is one hundred and twenty miles long. The principal rivers are the Hudson, forming parts of the eastern border; the Delaware, the western boundary, and the Passaic, Hackensack, Raritan, Neversink, and Shrewsbury. The climate of New Jersey is somewhat variable. The uplands are healthy, but marsh and malarial fevers are found in some of the low-lying districts. The mean annual temperature, as observed at Newark during a period of twenty-four years, was 50.50° F.; that of the summer 70.30° F., and of the winter 30.75° F. The average rainfall is about 45 inches. The death-rate of the State, according to the last United States census, is 0.21 per 1000 of population; phthisical mortality 2.34 per 1000. There are extensive forests of pine in the southern part of the State and several pretty lakes in the northern part. There is much pleasing scenery, and the proximity of the State to the great cities of New York and Philadelphia have made many sections favorite places of resort. Some of the New Jersey watering-places are frequented by visitors from all over the country. Among the most famous of these are Long Branch, Asbury Park, Ocean Grove, Atlantic City, and Cape May, along the Atlantic coast. Lakewood, in the pine region, has of late years become a popular winter resting-place for fashionable people of New York and Philadelphia. The State has few mineral springs, and these are comparatively unimportant. There are numerous highly mineralized artesian wells in different parts of the State, but they do not appear ever to have been used for medicinal purposes. As far as can be learned, only one locality is used as a resort.

PINE LAWN SPRING,

BERGEN COUNTY.

Post-office, Hohokus. The Pine Lawn Spring water, recently introduced into the markets, is obtained from an artesian spring at Hohokus, twenty-three miles from New York City. The place is not used as a resort, but we are informed that residents of the neighborhood attach considerable medicinal value to the water and use it in large quantities. The following analysis was made in 1897 by Messrs. Smith and De Roode, chemists, of Fraser & Co., New York:

PINE LAWN SPRING WATER.

Light Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	0.06
Sodium chloride	0.43
Sodium sulphate	0.32
Calcium sulphate	0.49
Calcium nitrate	0.66
Calcium carbonate	2.04
Magnesium carbonate	0.72
Alumina	Trace.
Silica	0.57
Total	5.29

The water is exceptionally free from organic matter, and presents no evidence of surface pollution. It is clear, palatable, and sparkling, and well adapted for the table.

SCHOOLEY'S MOUNTAIN SPRINGS,

MORRIS COUNTY.

Post-office, Schooley's Mountain. Hotel. Access from New York *via* the Delaware, Lackawanna and Western R. R. to Hackettstown, thence three miles by stage to springs; or *via* the Central R. R. of New Jersey to German Valley, thence two and one-half miles by stage; from Philadelphia *via* the Philadelphia and Reading R. R. to German Valley, etc.

Schooley's Mountain is a broad plateau in the northern part of New Jersey, 1200 feet above tide-water, overlooking the Musconetcong Valley on the north and German Valley on the south. The scenery in the vicinity is varied and picturesque, and the neighborhood abounds in beautiful walks, drives, landscapes, etc. Among the nearby points of interest are Lake Hopatcong, Budd's Lake, and the romantic Delaware Water Gap. The chalybeate spring, situated half a mile from the hotel (the Heath House), has enjoyed a reputation as a ferruginous tonic for many years. The following analysis was made by C. McIntyre, Jr., analytical chemist:

CHALYBEATE SPRING (SCHOOLEY'S MOUNTAIN SPRINGS).

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	0.58
Magnesium carbonate	1.60
Iron carbonate	0.58
Manganese carbonate	Trace.
Calcium carbonate	1.42
Calcium sulphate	1.68
Alumina	0.14
Ammonia	Trace.
Silicic acid	0.74
Sodium chloride	0.43
Total	7.17

A subsequent analysis, showing a larger percentage of iron, has been made; but the terms of the analysis are so dubious that we have not thought it well to introduce it. The waters are recommended in cases of general debility, torpor of the liver, and in renal and bladder disorders.

At the Heath House is another spring, which has been analyzed by Prof. George H. Cook, State geologist. The figures are presumed to refer to grains per United States gallon, in accordance with the analyses of the artesian wells and springs contained in the State Geological Reports:

HEATH-HOUSE SPRING.

Saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	8.00
Magnesium sulphate	2.00
Sodium chloride	31.00
Magnesium chloride	17.00
Silica	3.00
Calcium carbonate	16.00
Magnesium carbonate	7.00
Iron carbonate	4.00
Potassium chloride	3.00
Total	91.00

The analysis shows a water rich in mineral ingredients, but, as far as we can learn, it is not used for medicinal purposes. The Heath House and cottages consist of several detached buildings, none of them over three stories in height, with accommodations for 350 guests. They are situated in a beautiful lawn of twenty-five acres. It is stated that the temperature here averages 10° lower during the day and 15° to 20° lower during the night than at New York or at Philadelphia.

The following springs are used commercially:

Kalium Springs, Collingswood, Camden County.

Pine Grove Mineral Spring, Woodbury, Gloucester County.

We are informed that the Spa Spring, of Woodbridge, Middlesex County, is no longer used commercially.

NEW MEXICO.

New Mexico extends from 31° 20′ to 37° north latitude, and from 103° to 109° 9′ west longitude. The surface of the country consists of a series of elevated level plateaus, covered by mountain ranges that often rise into high peaks, with intervening fertile valleys. The average elevation of the entire Territory is 5600 feet above tide-water. The Sangre-de-Cristo range enters from Colorado and extends nearly to Santa Fé, and has several peaks ranging from 12,000 to 14,162 feet in height. In the northeast are the Raton Mountains; while, west of the Rio Grande, range after range of grand peaks rise up to the westward until the great continental divide of the Sierra Madre is reached. There is also a continuous range, bearing local names, below Santa Fé. This range runs along the east side of the Rio Grande, crossing the river at El Paso into Mexico. The chief rivers of the Territory are the Rio Grande Del Norte, known as the "Nile of the New World;" the Pecos, its principal affluent, and the Canadian, Gila, San Juan, and Little Colorado, tributaries of the Colorado. The rainfall is very light, varying from 8 inches in the valley of the Rio Grande to 20 inches near the Texas State line. The great Staked Plains is a treeless and waterless grassy plateau of 44,000 square miles and 5000 feet elevation. In the highlands is an abundant supply of timber, the pine, walnut, hemlock, cottonwood, aspen, cedar, oak, and other trees being found. The mountains bear great forests of evergreens, and the deserts yield the yucca palm, valuable for paper making. As might be expected in a region with such a diversity of surface conditions, New Mexico is rich in the picturesque. Some of the most romantic scenery in the world is found amid its broken, irregular mountain ridges; the fertile valleys are rich with gramma grass, while on every side lie the ruins of ancient cities and dried-up canals that remain only to whisper the story of a people whose history perished with them. The climate is dry and salubrious, mild and equable, the winters being followed by cool and invigorating summers. The mean annual temperature at Santa Fé is 50.54° F., that of the summer 70.50° F., and of the winter 30.28° F. The mortality-rate of the Territory, as computed from the United States census for 1890, was

16.24 per 1000. The phthisical death-rate showed the remarkably low figure of 0.63 per 1000 of population.

New Mexico abounds in warm and hot springs, some of which are of considerable importance. They are chiefly of the alkaline-saline-calcic varieties. Several of the springs were in use many years ago by the Franciscans and Dominicans, and by the native races prior to the advent of Europeans. Our information concerning the springs of the Territory is drawn partially from the Report of the United States Geological Survey, west of the 100th meridian (vol. iii., Geology), and from Peale's contributions, but chiefly from personal inquiries. Some of the springs analyzed by the Government geologists do not appear to be in use at this time.

HUDSON HOT SPRINGS,

GRANT COUNTY.

Post-office, Hudson. Hotel. Access *via* Atchison, Topeka and Santa Fé R. R. (Silver City branch) to Hudson, thence by coach to springs. The location is twenty-five miles from Deming, at the junction of the Southern Pacific and Atchison Railroads.

At present the accommodations for guests are limited, the hotel having been destroyed by fire and not rebuilt. Plans are completed, however, for the erection of a hotel of fifty rooms, with all modern conveniences, and it will no doubt be ready for occupancy before this work is printed. The location is 5000 feet above the sea-level, and is in a broad valley open on the south for many miles, and surrounded on other sides by mountains distant from ten to fifteen miles. On the east, four miles distant, flows the Mimbres River, whose valley, from one to two miles in width, is dotted with a succession of fine farms and orchards. The variations of temperature are never extreme in this region, the air being pure and dry and the rainfall light, occurring almost entirely in July and August. The flow of water from the springs has not been measured, but it is sufficient to irrigate eight acres of land. The following analysis of the Hot Spring was made by Prof. W. D. Church, chemist:

HUDSON HOT SPRINGS.

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Silica	1.55
Oxide of iron and alumina	0.50
Calcium carbonate	4.45
Magnesium carbonate	2.62
Soluble sulphates and carbonates of sodium and potassium	13.55
Sodium chloride	2.27
Total	24.94

Temperature of water, 142° F.

It is said that certain of the diseases of the blood, liver, kidneys, and stomach are much benefited by the hot-water baths conjoined with the internal administration of water of the cold spring. On account of the equable climate it is safe to visit this resort at any season of the year.

LAS VEGAS HOT SPRINGS,

SAN MIGUEL COUNTY.

Post-office, Las Vegas Hot Springs. Hotel. Access *via* Atchison, Topeka and Santa Fé R. R. to Las Vegas, thence by branch line six miles to springs. Through Pullman sleeping cars pass Las Vegas twice a day in both directions.

These springs are situated upon the southeastern slope of the Santa Fé range of the Rocky Mountains at an altitude of 6767 feet above the sea-level. They are about forty in number, and vary in temperature from ice-cold to very hot, the thermal springs ranging from 110° F. to 140° F. The following analysis of the waters of the largest of the latter, flowing 1250 gallons per hour, was made by Dr. Walter S. Haines, Professor of Chemistry at Rush Medical College, Chicago :

SPRING NO. 6 (LAS VEGAS HOT SPRINGS).

Saline.

One U. S. gallon contains :

Solids.	Grains.
Calcium carbonate	0.89
Magnesium carbonate	0.15
Sodium carbonate	8.38
Potassium carbonate	0.28
Sodium sulphate	3.35
Sodium chloride	14.68
Silica	3.50
Alumina	0.10
Volatile and organic matter	0.32
Lithium carbonate	Traces.
Sodium bromide	"
Total	31.65

In its chemical composition this water resembles in many respects that of the famous hot springs of Toeplitz, in Austria. The water is conducted to a commodious bath-house, where, under the supervision of the resident physician, all varieties of baths are administered by a corps of competent assistants. The baths are said to have accomplished excellent results in rheumatism, gout, and diseases of the skin and lymphatic system. Mud baths are a special feature and are used in obstinate or neglected cases. This vicinity partakes in a large degree of the magnificent climatic conditions prevailing in New Mexico. The average humidity of New Mexico, as shown by the recent reports of the United States Signal Service, varies from 29 to 43 per cent. according to locality—as compared with 72 per cent. for New York City, 73 per cent. for New England, 74 per cent. for the Middle Atlantic, and 79 per cent. for the Southern Atlantic States. The climate here is peculiarly adapted to persons afflicted with hay-fever, bronchial asthma, and most forms of throat and lung diseases. The rarity of the air, caused by the high elevation, renders this region unfavorable for cardiac affections. Among the many attractions surrounding the Las Vegas Hot Springs may be mentioned the magnificent mountain scenery, the beautiful drives, and the unrivaled opportunities for fishing and hunting. The Montezuma is a first-class hotel, affording comforts and conveniences to meet the most exacting demands. It has accommodations for 250 guests.

OJO CALIENTE (HOT SPRINGS),

Taos County.

Post-office, Ojo Caliente. Hotel. Access: Take Denver and Rio Grande R. R. to Barrancas Station; thence twelve miles by stage to springs.

These celebrated hot springs are located at an elevation of about 6000 feet above the sea-level in the region of the ancient cliff dwellers, twenty-five miles west of Taos and fifty miles north of Santa Fé. There is now a commodious hotel at the resort, having accommodations for about 100 guests. The surrounding country is broken and mountainous, and the climate of the usual delightful New Mexican variety. The hottest summer day recorded at the springs in recent times was 93° F. and the coldest winter day 20° F. The resort is kept open all the year round. The springs are fifteen in number, and vary in temperature from 90° F. to 122° F. Their flow has not been measured, but it is estimated by Congressman Antonio Joseph, the proprietor, at about 4200 gallons hourly. The following analysis was made by Prof. O. C. Marsh:

OJO CALIENTE.

Thermal. Alkaline-chalybeate.

One U. S. gallon contains: Solids.	Grains.
Sodium carbonate	91.52
Magnesium carbonate	1.26
Iron carbonate	5.90
Lithium carbonate	0.12
Sodium chloride	22.18
Calcium carbonate	2.42
Potassium sulphate	3.00
Sodium sulphate	7.92
Silica	1.22
Total	135.54

An analysis made in 1892 of the "New Spring" by W. T. Hillebrand, acting chief chemist of the United States Geological Survey, showed the presence of large quantities of carbonate of sodium, besides salts of lithium, potassium, strontium, barium, magnesium, and iron, with a considerable proportion of carbonic acid gas. The waters here have a great reputation in the treatment of advanced syphilis, chronic induration of the lymphatic glands, gout, and rheumatism.

From a neat brochure issued by the Atchison, Topeka and Santa Fé R. R. we have obtained a brief account of the following mineral springs of New Mexico

CHICO SPRINGS,

Colfax County.

Location, twenty miles north of Maxwell City. Stages run daily between the two places. Here are found, besides the spring waters, pleasant surroundings, romantic scenery, etc. At the hotel the visitor will find well-kept rooms, a generous cuisine, a good library, and amusements in the way of billiards, etc. The place is highly recommended as a health resort.

COYOTE MINERAL SPRINGS,

Bernalillo County.

These springs are located at Coyote Canyon, twelve miles from Albuquerque. Some of these springs are now used commercially. The waters are mildly laxative and diuretic. This is a favorite place for summer visitors, and may be regarded as a pleasure rather than a health resort

JEMEZ HOT SPRINGS,

Bernalillo County.

Post-office, Archuleta. These springs are located in the beautiful Jemez Mountains, forty-five miles from Albuquerque, with which they are connected by daily stages during the summer months. There are two groups of springs, known as the upper and the lower. The upper group, at Archuleta, is most frequented. These springs are located in the San Diego Canyon, 6620 feet above the level of the sea. They are forty in number, and range in temperature from 70° F. to 105° F. They are chiefly saline in character. The lower group, two miles south, are ten or more in number, and have temperatures ranging from 94° F. to 168° F. They are also saline.

SELDEN HOT SPRINGS,

Dona Ana County.

These springs are sixteen miles north of Las Cruces, and are patronized by those afflicted with rheumatism. Visitors camp out; there are no accommodations.

Other springs of New Mexico worthy of mention are the following:

Aztec Spring (Ojo Xiganti), four miles east of Santa Fé, Santa Fé County. The water is mildly alkaline, and is sold in Santa Fé.

There are numerous undeveloped springs in the Territory, chiefly thermal.

NEW YORK.

The State of New York extends from 71° 51′ to 79° 47′ 25″ west longitude, and from 40° 29′ 40″ to 45° 0′ 42″ north latitude. Stretching thus over $4\frac{1}{2}°$ of latitude, New York possesses a great diversity of soil and climate, and presents some of the finest lake, mountain, and river scenery in the world. Although resting only one corner upon the Atlantic, the State has a seacoast—extended by Staten Island and Long Island—of two hundred and forty-six miles, and on these islands are found many lovely and picturesque summer resorts. The important rivers of the State are the broad and noble Hudson, famous the world over for its romantic and impressive scenery; the magnificent St. Lawrence, forming the northeast boundary and the outflow of the great lakes, which pours into the ocean more water than any river in the world except the Amazon; the picturesque Mohawk, and the Genesee, with its numerous falls. In the eastern part of the State the Catskill Mountains cover over 500 square miles, and reach a height of 3800 feet. The Adirondack Mountains, in the wild region west of Lake Champlain, rise to various heights and are known by different names. Mt. Marcy, the loftiest peak, reaches an elevation of 5337 feet. The State contains among its varied attractions more than one thousand lakes, some of them of rare beauty and loveliness. Among the most noted, included in whole or in part within in the State limits, are Lakes Erie, Ontario, Champlain, George, Otsego, Seneca, Chautauqua, Canandaigua, Keuka, Mahopac, Round, and Cayuga. In the mountain region in the northeastern part of the State are Long Lake, Tupper, St. Regis, Placid, Calden, Avalanche, Schroon, Upper and Lower Saranac, Racquette, Sanford, and Pleasant Lakes. The pleasure resorts of the State along its lakes, waterways, and mountains are among the most attractive and popular in the country. There is a great diversity of climate. It is subject to sharp, sudden changes, but on the whole is healthful and agreeable. The winters in the Adirondack region are long and severe, but the air is dry and bracing, and in certain localities beneficial in chronic pulmonary troubles at all seasons. The mean annual temperature, as observed at Albany, is 47.95° F., and in the city of New York 51.83° F. The rainfall varies from 44 inches in the Hudson valley to 32 inches in the valley of the St. Lawrence. The mortality-rate in 1890 was 20.53 per 1000 of population; death-rate from consumption was 2.47 per 1000 of population.

The mineral springs of New York are numerous, and many of them widely celebrated. In the United States Geological Reports the State is credited with a larger number of localities than any of her sisters in the Union. This is probably due to a great extent to the great commercial success of the Saratoga Springs, perhaps the oldest and undoubtedly one of the most popular spring resorts of the United States. The numerical supremacy of the State in the Geological Reports is also no doubt partially due to the fact that its springs have undergone a more thorough examination and have been more carefully studied than those of other States. New localities are constantly coming into notice, however, while a number of the older ones have been abandoned. The following data have been obtained chiefly by personal visits and correspondence. We have also drawn upon the Geological Reports and upon the previous works on mineral springs for information concerning some localities. We have been unable to gain positive information as to the present status of some of the springs. They are indicated thus *. It will be observed that all varieties of mineral waters are found in the State, the saline and alkaline types predominating. The highest temperature reached by any of the springs is at Lebanon, where the thermal spring attains 75° F. Several of the Saratoga and Ballston springs have temperatures that exceed the mean annual temperatures of those places, and are therefore in a strict sense thermal springs.

ADIRONDACK MINERAL SPRING,

WASHINGTON COUNTY.

Post-office, Whitehall. The waters of this spring are found in the markets under the name of Adirondack Medicinal Water. It has been analyzed by Prof. C. Collier, of the University of Vermont, with the following results:

ADIRONDACK MEDICINAL WATER.

Saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	5.14
Potassium carbonate	5.32
Calcium carbonate	18.54
Magnesium carbonate	16.62
Lithium carbonate	0.02
Manganese carbonate	Trace.
Iron carbonate	5.04
Calcium sulphate	11.13
Sodium chloride	14.34
Alumina	Trace.
Silica	0.74
Total	76.89

The analysis indicates a chalybeate water of great potency. Experience has shown its efficacy in cases of anæmia and general debility, subacute and chronic articular rheumatism, muscular rheumatism, and certain cutaneous affections.

AVON SULPHUR SPRINGS,

LIVINGSTON COUNTY.

Post-office, Avon. Hotel. Access: Branches of the Erie system extend in four directions from Avon, forming direct communication with New York, three hundred and sixty-seven miles distant; Rochester, eighteen miles; and Buffalo, sixty-six miles. The village has a surpassingly beautiful location, nestled as it is in the charming and picturesque valley of the Genesee. The springs are on a somewhat lower level, about three-quarters of a mile from the village. The surrounding country is delightfully interspersed with fine drives, charming lakes, streams, etc. The medicinal qualities of the springs were discovered in 1792, and they have been used as a resort since that time. The springs found to possess the greatest efficacy are those known as the "Upper" and the "Lower" Spring. The "Congress" and the "Magnesia" Springs are also used to some extent, the latter being the favorite for drinking.

ANALYSIS OF AVON SULPHUR SPRINGS.

Saline-calcic. Sulphureted.

One U. S. gallon contains:	Upper Spg. J. Hadley.	Lower Spg. J. R. Chilton.	Congress Hall Spg. H. M. Baker.
Solids.	Grains.	Grains.	Grains.
Calcium carbonate	8.00	29.33	9.25
Sodium sulphate	16.00	13.73	21.02
Calcium sulphate	84.00	57.44	27.61
Magnesium sulphate	10.00	49.61	19.07
Sodium chloride	18.40	...	29.11
Calcium chloride	...	8.41	...
Sodium iodide	...	Trace.	...
Sodium sulphide, Calcium sulphide,	...	...	99.55
Total	136.40	158.52	205.61
Gases.	Cubic inches.	Cubic inches.	Cubic inches.
Sulphureted hydrogen	12.00	10.02	27.63
Carbonic acid	5.60	3.92	22.04
Oxygen	...	0.56	0.97
Nitrogen	...	5.42	3.88
Total	17.60	19.92	54.52

The chemical constituents of the magnesia spring are supposed to be similar to those of the lower spring, with, however, a greater proportion of sulphate of magnesia. In consequence of the considerable proportion of this ingredient the two latter springs have valuable laxative and purgative properties. They thus become useful in disorders of the gastro-intestinal tract accompanied by torpor of the liver and constipation. The water also produces an increased activity of the functions of the skin, and free diaphoresis often ensues. The water also possesses valuable antacid properties, and has been found of special benefit in cases of dyspepsia attended by flatulence, heartburn, and gastric catarrh. Both internally and in the form of baths these waters have been found beneficial in cases of obstinate rheumatism, diseases of the urinary tract, and in various skin disorders. Facilities for all forms of hot, cold, and electric baths are supplied. Taken altogether, Avon Springs offer many pleasant features in the way of charming surroundings, agreeable climate, spring waters and baths, and other artificial and natural attractions to invite the tourist or invalid.

*ALBANY ARTESIAN WELL,

Albany County.

Location, Ferry Street, Albany.
Analysis by William Meade :

ALBANY ARTESIAN WELL.

Saline-calcic.

One U. S. gallon contains :

Solids.	Grains.
Sodium carbonate	40.00
Calcium carbonate	32.00
Magnesium carbonate	16.00
Iron carbonate (with silicate)	8.00
Sodium chloride	504.00
Total	600.00

A later analysis by L. C. Beck shows a smaller proportion of magnesium carbonate (12 grains per gallon) and of sodium chlorides (472 grains per gallon). There were also 4 grains of chloride of calcium per gallon. The analyses are otherwise identical. The well is 500 feet in depth.

AYER'S AMHERST MINERAL SPRINGS,

Erie County.

Post-office, Williamsville. Hotels. Access : The Buffalo and Williamsville trolley line is one and one-half miles distant. The springs are four miles, two miles, and four miles, respectively, from the following railroad stations : the West Shore, the Lehigh Valley, and New York Central (branch).

The springs, owned by Mr. A. D. Ayer, are two in number, and are located in the town of Amherst, two miles northeast of Williamsville and six miles from Buffalo. The principal spring (artesian) was bored about eight years since. According to a qualitative analysis by Herbert M. Hill, Ph.D., Professor of Chemistry and Toxicology at the University of Buffalo, it contains the following ingredients:

Calcium sulphate.	Magnesium sulphate.
Iron bicarbonate.	Sodium chloride.
Calcium bicarbonate.	

The water cannot be classified from this analysis, but it would appear to be a calcic-chalybeate, with sufficient Epsom salts to give it laxative properties. A complete quantitative analysis is desirable. It is highly recommended for chronic constipation, sick headache, dyspepsia and gastric catarrh, hemorrhoids, and other conditions due to a disordered state of the gastro-intestinal tract. A sanitarium at the springs is under contemplation.

*BALLSTON SPA,

SARATOGA COUNTY.

Post-office, Ballston. Hotels. Access: From Albany *via* Delaware and Hudson R. R., thirty miles north. The location is seven miles southwest of Saratoga Springs.

The fame of Ballston Springs is almost coeval with that of Saratoga, and at one time it was a formidable rival of that celebrated resort. The town of Ballston is an exceedingly pleasant and attractive one, where those who wish to avoid the excitement of Saratoga may live quietly and drink excellent mineral waters at the same time. Some of the springs are very heavily mineralized. We present analysis of four of the most important:

BALLSTON MINERAL SPRINGS.

Saline.

One U. S. gallon contains:	Sans Souci Spring. J. H. Steele.	Artesian Lithia Spring. C. F. Chandler.	Franklin Artesian Well. C. F. Chandler.	United States. L.C.Beck.
Solids.	Grains.	Grains.	Grains.	Grains.
Sodium carbonate	12.66	...	...	16.88
Sodium bicarbonate	...	11.93	94.60	...
Calcium carbonate (with iron oxide)	43.41	...	...	29.20
Calcium bicarbonate	...	238.16	202.33	...
Magnesium carbonate	...	...	...	5.76
Magnesium bicarbonate	39.10	180.60	177.87	...
Strontium bicarbonate	...	0.87	Trace.	...
Lithium bicarbonate	...	7.75	6.78	...
Iron carbonate	5.95	...	...	...
Iron bicarbonate	...	1.58	1 61	...
Barium bicarbonate	...	3.88	1.23	...
Sodium sulphate	...	...	...	1.76
Potassium sulphate	...	0.52	0.76	...
Sodium phosphate	...	0.05	0.01	...
Sodium biborate	...	Trace.	Trace.	...
Sodium chloride	143.73	750.03	659.34	424.96
Potassium chloride	...	33.28	33.93	...
Sodium bromide	...	3.64	4.67	...
Calcium fluoride	...	Trace.	Trace.	...

One U. S. gallon contains:	Sans Souci Spring. J. H. Steele.	Artesian Lithia Spring. C. F. Chandler.	Franklin Artesian Well. C. F. Chandler.	United States. L.C.Beck.
Solids.	Grains.	Grains.	Grains.	Grains.
Sodium iodide	1.30	0.12	0.24	...
Alumina	...	0.08	0.26	...
Silica	1.00	0.76	0.74	8.00
Organic matter	...	Trace.	Trace.	...
Total	247.15	1233.25	1184.37	486.56
Gas.	Cubic ins.	Cubic ins.	Cubic ins.	Cubic ins.
Carbonic acid	...	426.114	460.06	244.00

It will be seen that these waters are quite similar to those of Saratoga. Some of them are indeed much richer in mineral ingredients than any of the Saratoga waters. They are all saline, but some of them, as will be observed, are quite heavily impregnated with calcium, iron, and magnesium. The waters are certainly of great value for medicinal purposes. Among other springs at Ballston may be mentioned the Washington Lithia Well (old Conde Dentonean), and the "Iron" spring.

*CHERRY VALLEY SPRINGS,

OTSEGO COUNTY.

Post-office, Cherry Valley. Hotels in village. Access *via* Delaware and Hudson R. R. (Susquehanna division) to Cherry Valley, sixty-eight miles west of Albany; thence two miles to springs.

These springs are situated in a portion of New York State rendered historical by the Indian wars. Close by the springs are the Tekaharawa Falls, the water here having a perpendicular drop of 152 feet. As far as we can learn, no regular resort has been established here, but a bath-house is maintained for the accommodation of visitors during the summer months.

CHERRY VALLEY SPRINGS.

Sulphureted.

One U. S. gallon contains:	Bath-house Spg. J. R. Chilton.	Spg. north of Bath-house. Dr. Perkins.
Solids.	Grains.	Grains.
Calcium carbonate	9.41	14,75
Magnesium carbonate	17.82	9.96
Iron carbonate	...	2.45
Sodium sulphate	11.08	...
Calcium sulphate	57.68	149.46
Magnesium sulphate	24.56	2.13
Sodium chloride	12.44	...
Calcium chloride	2.80	...
Potassium chloride	...	2.49
Magnesium chloride	3.68	...
Calcium sulphide	0.60	...
Iron oxide,	0.36	...
Alumina,		...
Silica,		3.64
Organic matter	0.28	...
Total	140.71	184.88

The "Phosphate" Spring, analyzed by Prof. Chandler in 1876, shows 61.32 grains of solid matter per United States gallon.

CHITTENANGO SULPHUR SPRINGS,

Madison County.

Post-office, Chittenango. Access: This pleasant summer resort is located about three miles south of the Chittenango stations, on the New York Central and on the New York, West Shore and Buffalo railroads, between the beautiful villages of Chittenango and Cazenovia. The springs are reached from Chittenango by an electric railroad, by carriages, and by a stage line.

The country surrounding the springs is hilly and covered by a growth of hemlock, pine, beech, and maple. Through the valley between the hills flows the outlet of Cazenovia Lake to Oneida Lake, affording a stream twenty to seventy feet in width and well stocked with California, German, and brook trout. The hotel is large and commodious, with extensive verandas, spacious parlors, and high and well-ventilated rooms, capable of accommodating 300 guests. The hillside grounds, in the rear of the hotel, including several acres, are covered with wild woods, intersected with walks, affording a cool and delightful strolling place in hot summer days. The springs are three in number, known as the "White Sulphur," the "Magnesium Sulphur," and the "Lithium Sulphur" Springs. The following analyses were made by Prof. Chandler, of New York:

CHITTENANGO SULPHUR SPRINGS.

Calcic-sulphureted.

One U. S. gallon contains:	White Sulphur Spring.	Lithium Sulphur or Cave Spring.	Magnesia Sulphur Spring.
Solids.	Grains.	Grains.	Grains.
Magnesium bicarbonate	22.02	23.97	. . .
Iron carbonate	. . .	. . .	20.78
Iron bicarbonate	0.08	0.16	0.32
Sodium hyposulphite	. . .	0.26	0.02
Sodium sulphate	0.21	. . .	. . .
Calcium sulphate	81.42	106.12	115.09
Strontium sulphate.	Trace.	Trace.	Trace.
Magnesium sulphate	1.95	7.59	12.72
Sodium chloride	1.04	1.57	1.83
Potassium chloride	0.16	0.23	0.33
Lithium chloride	Trace.	Trace.	Trace.
Sodium sulphide	0.12	0.39	0.75
Calcium sulphide	. . .	1.12	0.93
Alumina	0.08	0.22	Trace.
Silica	0.28	0.52	0.58
Total	107.36	142.15	153.35
Gases.	Cubic ins.	Cubic ins.	Cubic ins.
Sulphureted hydrogen	0.88	2.75	5.62
Carbonic acid	20.48	15.93	19.43

Temperature of water, 45° F.

The water of the White Sulphur Spring also contains a trace of free sulphur, which accounts for its pearly-white hue. This water is recommended for rheumatism, neuralgia, gout, and skin diseases. The magnesia water is transparent, but deposits a sediment said to consist of magnesia, yellow sulphur, and chloride of potassium. This water possesses marked tonic properties, and is much used in general debility, nervous affections, and insomnia. The water of the lithium spring is also perfectly clear and very pleasant to the taste. It has enjoyed much reputation in the treatment of kidney affections. There is a large bath-house in connection with the springs, in which hot mineral water, vapor, and electric baths are furnished.

CLIFTON SPRINGS,

ONTARIO COUNTY.

Post-office, Clifton Springs. Hotel and sanitarium. Access *via* Auburn branch of the New York Central and by the Lehigh Valley Railroads.

This resort is located in one of the most healthful parts of the State, midway between the villages of Geneva and Canandaigua. The location is about 617 feet above the sea-level, and the surrounding country is somewhat hilly. An average summer temperature of about 75° F. to 85° F. is the rule. The springs are very numerous, but only five are in use at present. Dr. Henry Foster, the superintendent, sends us the following analysis by the late Prof. J. R. Chilton:

SULPHUR SPRING (CLIFTON SPRINGS).

One U. S. gallon contains :

Solids.	Grains.
Calcium carbonate	9.68
Magnesium carbonate	13.12
Sodium sulphate	7.76
Calcium sulphate	69.20
Magnesium sulphate	16.48
Sodium chloride	9.28
Calcium chloride	4.08
Magnesium chloride	4.08
Organic matter	Trace.
Total	133.68

Sulphureted hydrogen gas, present.
Carbonic acid gas, present.

This water is quite similar to that of the Greenbrier White Sulphur Springs of West Virginia. It is used to supply the Clifton Springs Sanitarium, the important feature of this resort. A staff of eight physicians, six gentlemen and two ladies, is maintained at the sanitarium, and it is believed that the facilities for treating certain classes of diseases are unsurpassed anywhere. All varieties of baths are here to be found, as well as all the modern appliances and methods of using electricity. The use of massage, the Swedish movement, and the various forms of gymnastics also receive due attention. The sanitarium building, with its recently constructed annex, affords accommodations for 450 persons. All modern contrivances for the comfort and health of the guests are provided —elevators, an electric-bell service, a solarium, roof-garden, etc. The surrounding park, containing more than fifty acres, beautified by well-kept lawns, spacious pavilions, attractive walks, miniature lakes, shady groves, flowers, etc., provide a healthful and restful retreat. The house is kept open for guests all the year, but the greater number visit the place during the summer months.

COLONIAL SPRINGS,

SUFFOLK COUNTY.

Post-office, West Deer Park. Hotel (Colonial House) new. Access *via* Long Island R. R., thirty-four miles east of New York.

These springs are situated near the base of a bluff that rises about one hundred feet above the great plain of Long Island, and come through a large deposit of clay in which are found considerable quantities of iron and other minerals. The location is about 200 feet above the sea-level and near the middle of the island, being five miles from Babylon, on the great South Bay, and seven miles from Huntington, on the Sound. It is said that the temperature during the winter months will average 4° warmer than at Lakewood, N. J. There are two springs in use, known as the "Colonial" and the "Mo-Mo-Ne" Spring. The former has been known and used for many years by people in the vicinity suffering from kidney troubles. While excavating to make a reservoir for the Mo-Mo-Ne, several years since, four Indian wells were discovered two or three feet below the present surface. These were made from the trunks of the swamp aspen, or poplar—a tree of the Southern States. The trunks had been burnt out in the centre with hot stones, in the way that the Indians constructed their canoes. The smallest of the wells were left in position, while the others are on exhibition at the Colonial House. This discovery seems to prove beyond doubt that the waters here were known to and used by the aboriginese before the advent of Europeans.

The waters of the two springs were analyzed in 1894 by Professors Chandler and Pellew, of Columbia College, New York:

COLONIAL SPRINGS.

Light Alkaline-chalybeate.

One U. S. gallon contains: Solids.	Colonial Spring. Grains.	Mo-Mo-Ne Spring. Grains.
Potassium sulphate	0.19	0.12
Potassium chloride	0.43	0.06
Sodium chloride	0.80	0.48
Sodium carbonate	...	0.06

One U. S. gallon contains: Solids.	Colonial Spring. Grains.	Mo-Mo-Ne Spring. Grains.
Calcium carbonate	0.36	0.09
Magnesium carbonate	0.17	0.13
Oxide of iron and aluminium	0.02	0.02
Silica	0.44	0.47
Organic and volatile matter	0.09	0.19
Total	2.50	1.62

These waters are very pure, the analysis showing but a minute proportion of organic matter. They are well qualified for domestic use. The Colonial Spring is quite similar to the Poland Spring of Maine. The water has a mild diuretic and tonic action. It has been found useful in kidney and bladder troubles, and may be taken in large quantities. These waters are beginning to attract considerable attention in New York and Brooklyn.

*COLUMBIA SPRINGS,

COLUMBIA COUNTY.

Post-office, Hudson. Hotel. Access *via* New York Central and Hudson River R. R., or by steamer on the Hudson River to Hudson, one hundred and fifteen miles north of New York and twenty-seven miles south of Albany; thence four miles northeast by carriage to springs.

This is a very pleasant, quiet resort, where salubrious air and charming rural scenery may be enjoyed. The springs are four in number. An analysis by Prof. Atwood shows the following contents:

COLUMBIA SPRINGS.

Saline-sulphureted.

One U. S. gallon contains: Solids.	Grains.
Calcium carbonate	21.79
Sodium hyposulphite	8.15
Calcium sulphate	64.94
Sodium phosphate	2.14
Sodium chloride	84.72
Potassium chloride	1.19
Magnesium chloride	31.43
Iron sesqui-chloride	3.42
Loss	0.82
Total	218.60

Sulphureted hydrogen gas, 4.49 cubic inches.

This analysis shows a very valuable saline-sulphur water, with a considerable proportion of iron. A new examination is desirable, as we are informed this analysis was made many years ago.

DEEP ROCK SPRING,

OSWEGO COUNTY.

Post-office, Oswego. Hotel. Oswego is located on Lake Ontario, about fifty miles south of the head of the St. Lawrence River. It is reached by the Delaware, Lackawanna and Western; Rome, Watertown and Ogdensburg; and the New York, Ontario and Western Railroads.

The Deep Rock Spring was opened to the public and the water placed on the market in the spring of 1871. Since that time it has had an extensive sale, competing fairly in the markets with the most popular waters of the time. The following analysis was made by Prof. Silas H. Douglass, of the University of Michigan :

DEEP ROCK MINERAL WATERS.

Saline.

One U. S. gallon contains :

Solids.	Grains.
Sodium chloride	308.18
Potassium chloride	149.08
Magnesium chloride	10.24
Calcium chloride	18.19
Silica	71.70
Sulphuric acid	Trace.
Iron protoxide	"
Loss	1.78
Total	559.17

Carbonic acid gas, not determined.
Temperature of water, 50° F.

The water is strongly saline and actively diuretic without cathartic effects. It is useful in rheumatism and some forms of kidney and bladder troubles. It is claimed that the water contains a greater proportion of potassium chloride than that of any other known spring. A valuable sulphur spring has been discovered in a ledge of rocks fifty-seven feet above the source of Deep Rock, which it is intended to utilize for both drinking and bathing purposes.

The city of Oswego has a charming location, and is one of the most desirable summer visiting places in the country. The well-known Doolittle House, adjoining the springs, has accommodations for 150 guests.

*DOXTATTER'S MINERAL WELL,

MONROE COUNTY.

Post-office, Rochester. Hotels. This well is described in some of the older works as Longmuir's Well. It is located in the city of Rochester. An analysis by L. C. Beck, many years ago (1842) resulted, as follows :

DOXTATTER'S MINERAL WELL.

Saline-sulphureted. Calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium bicarbonate, Magnesium carbonate, Iron oxide,	11.84
Sodium sulphate	55.92
Calcium chloride	52.16
Total ingredients	119.92
Gases.	**Cubic inches.**
Sulphureted hydrogen	17.28
Carbonic acid	Trace.

This analysis is evidently incomplete. It shows sufficient sulphate of soda to give it aperient properties. The water is also highly charged with sulphureted hydrogen.

DRYDEN SPRINGS,

TOMPKINS COUNTY.

Post-office, Dryden. Hotel and sanitarium. Access *via* Lehigh Valley R. R. (Auburn division) to Dryden Station; thence one-half mile west to springs. Dryden is situated midway between Auburn and Oswego, and midway also between Ithaca and Cortland, the distance to each of the latter-named places being ten miles.

The village is on an elevated plateau, overlooking the Catskill Range. The surrounding region is remarkable both for the beauty and picturesqueness of its scenery and for the purity and salubrity of the atmosphere. The grounds about the springs are tastefully laid out, and furnish every facility for outdoor exercise and recreation. The Dryden "Sulphur" and "Chalybeate" Springs are among the oldest and most favorably known in the State. The waters of the "Crystal" Spring are said to be identical in temperature and quality with the Poland Spring. The "Magnetic" Spring, which is used for bathing, is also a very valuable water. All of the waters are quite palatable, and none are offensive even to the most fastidious taste. They have never been subjected either to a thorough qualitative or quantitative analysis. An important adjunct to the springs is the sanitarium—a large, four-story building with extensive piazzas and cheerful, well-furnished rooms. The building contains many bath-rooms, and a large and convenient assembly-room for calisthenic exercises, religious services, and social and literary entertainments. The building is equally well adapted for the comfort of patients or for those who desire a quiet country home during the summer months.

ESPERANZA MINERAL SPRINGS,

Yates County.

Post-office, Penn Yan. Access by steamers on Lake Keuka or by a trolley line between Penn Yan, which is six miles distant in one direction, and Branchport, one mile distant, in the other.

The springs are located at the head of the west branch of Lake Keuka, one of the most charming and picturesque of the many series of lakes which give the name of the lake section to this part of central New York. Lake Keuka is 700 feet above the ocean-level, and within a mile of the springs an elevation of 1100 feet higher may be reached. This is the great grape-producing section of New York, and the country about the lake is dotted on every hand with vineyards. Lovely walks, drives, and bicycle paths abound on all sides. The largest of the springs flows about 1000 gallons hourly. The water has never been examined quantitatively. A qualitative analysis shows the following ingredients :

ESPERANZA SPRINGS.

Calcic-sulphureted.

Solids.

Calcium carbonate.
Calcium sulphate.
Calcium phosphate.
Calcium chloride.
Magnesium chloride.

Solids.

Magnesium carbonate.
Magnesium sulphate.
Iron oxide (trace).
Sulphureted hydrogen gas.
Carbonic acid gas.

Temperature of water, 51° F.

The water has a strong odor, and tastes of sulphur when first taken from the spring; but this disappears after a few hours, and the water becomes very palatable. There is no hotel at the springs, though there are many within easy reach. Lake Keuka is well supplied not only with hotels, but many cottages, steam yachts, sail-boats, etc. No systematic effort has so far been made to put the Esperanza Spring waters on the market, although much has been sold and given great satisfaction.

*EXCELSIOR SPRING,

Onondaga County.

Post-office, Syracuse. This spring is located in the city of Syracuse. It was analyzed by Charles A. Goessman in 1868, with the following results :

EXCELSIOR SPRING.

Saline-calcic.

One U. S. gallon contains :

Solids.	Grains.
Calcium carbonate	15.24
Calcium sulphate	36.45
Sodium chloride	584.53

One U. S. gallon contains:

Solids.	Grains.
Alumina, Silica,	1.02
Sodium sulphate	13.16
Magnesium chloride	17.69
Magnesium bromide	0.15
Total	668.24

Carbonic acid gas present.

This analysis indicates a very potent saline water, with diuretic and slightly aperient properties.

GENEVA LITHIA SPRING,

ONTARIO COUNTY.

Post-office, Geneva. Location, Geneva. The well-known Geneva lithia water is obtained from an artesian well over 800 feet deep, which was bored in 1886. Issuing from a stratum of pervious rock defined by a layer of mediæval sandstone sixty feet thick and a deep substratum of hard slate, the water is forced up by an internal pressure of one hundred and twenty pounds to the square inch, and if unimpeded at the surface, would form a fountain eighty feet high. The water is bright, clear, and sparkling, being agreeable to the palate and excellently adapted for table use. The following analysis was made by Prof. A. Auchie Cunningham, F.C.S.:

GENEVA LITHIA WATER.

Lithiated-saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	83.13
Magnesium carbonate	16.00
Potassium chloride	13.40
Sodium chloride	24.54
Sodium sulphate	17.64
Aluminium sulphate	8.75
Lithium bicarbonate	10.03
Lithium sulphate	4.10
Iron carbonate	2.15
Calcium sulphate	18.75
Calcium carbonate	35.84
Phosphoric acid	Trace.
Total	234.33

There is an entire absence of organic matter. The analysis shows a valuable lithia water, which possesses many excellent qualities. Aside from its strong impregnation with the bicarbonate and sulphate of lithia, it possesses sufficient of the sulphates of magnesium and sodium to give it laxative properties, and enough iron to make it a valuable ferruginous tonic when taken continuously.

The water is used commercially, and has an extensive sale. It has the indorsement of many prominent physicians of the great Eastern cities. The water resembles that of a spring at Rippoldsau, in the Duchy of Baden, but is more heavily charged with iron and free phosphoric acid. It is extensively employed in anæmic states and general debility and in many of the conditions resulting from the uric-acid diathesis, viz., gout, dyspepsia, rheumatism, renal and vesical calculus, Bright's disease, etc.

GLEN SPRINGS,

SCHUYLER COUNTY.

Post-office, Watkins. Hotel and sanitarium. Access : Watkins is situated on the Northern Central R. R., between Elmira and Rochester. This road (a division of the Pennsylvania system) runs from Rochester to Baltimore, Philadelphia and Washington. It connects at Rochester with the New York Central, West Shore, Michigan Central and other railroads, at Canandaigua with the Auburn branch of the New York Central, and at Elmira with the Erie and the Delaware, Lackawanna and Western R. R. The Fall Brook R. R. also has a depot one and one-half miles from Watkins. A transfer stage meets Fall Brook trains, and the Glen Springs coach meets all day trains on the Northern Central R. R. The Lehigh Valley road has a station at Burdette, about two miles from Watkins.

This beautiful and modern health resort and watering-place stands upon a broad plateau 300 feet above Seneca Lake, whose winding course it overlooks for nearly thirty miles. It is surrounded by pine forests and backed by an amphitheatre of hills rising in regular terraces to nearly 1500 feet. At the foot of the hill, less than a quarter of a mile away, lies the village of Watkins, with its churches, shady streets, and lovely homes, while the entrance to the famous Watkins Glen and the landing of the superb Seneca Lake steamers are both within seven minutes' easy walking distance. Seneca Lake is one of the most remarkable bodies of water known. It is fed by deep springs, and has been frozen over only twice during the last century. For beauty of scenery and richness of coloring it has no superior; its shores are grand and picturesque, the sides thickly wooded in places, in others covered with fruit orchards and vineyards. This great body of water, nearly forty miles long and from two to four miles in width, exerts an unquestioned modifying influence on the atmosphere, tempering it in winter and cooling and freshening it in summer. A remarkable feature of this region is the great number of its sunny days during the fall, winter, and spring. The record for 365 days has shown that there were only fifty-five cloudy days, and seventeen of those were in May. These features tend to make the location a very desirable winter as well as summer resort. The Glen Springs Park comprises sixty acres of woodland and lawn, about equally divided, and one can wander for miles over well-built walks, obtaining from almost every point grand and beautiful vistas of lawn, lake, forest, and glen. Within the park are bowling-alleys, tennis courts, croquet grounds, and golf links. Pleasant drives abound in every direction, while to those who prefer the water the fine, large steamers of the Seneca Lake Navigation Company, plying six times a day between Geneva and Watkins, afford every comfort and luxury. Good fishing is found in Seneca Lake, and within easy driving distance over good roads one can reach Keuka, Lamoka, Cayuta, and Little Lakes, all famous fishing resorts. The main building of the Glen Springs sanitarium, heated by steam and lighted by electricity and gas, consists of four stories and a basement, constructed in a substantial manner of brick and stone. The annex, a new building, has accommodations for 100 guests. The two buildings are connected by a wide corridor enclosed in glass and heated in cold weather by steam. It affords ample space for exercise, and forms an excellent solarium during the winter months. These buildings are provided with all modern comforts and luxuries. There are several large mineral springs located on the grounds which are used for drinking and baths. The following analyses of the first four springs were made by Prof. S. A. Lattimore, of the University of Rochester. The fifth spring was analyzed by Prof. Charles F. Chandler:

SENECA SPRING.

Calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	9.90
Calcium sulphate	0.47
Magnesium carbonate	2.10
Sodium chloride	0.12
Silica	0.07
Iron oxide	Trace.
Total	12.66

The water is entirely free from organic matter. This spring is situated two hundred feet higher than the buildings. It flows about 4000 gallons of water per hour, which is used in the buildings for general domestic purposes.

VULCAN SPRING.

Saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	29.80
Magnesium carbonate	11.37
Iron carbonate	1.87
Sodium chloride	149.06
Alumina	Trace.
Silica	"
Total	192.10

Carbonic acid gas, large quantities.

This is a clear, sparkling water, and issues from the rocks at a depth of 100 feet. It resembles the waters of Kissengen, and has diuretic, tonic, mildly aperient and slightly alterative properties.

SALUBRIA SPRING.

Muriated-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	196.28
Calcium carbonate	19.68
Magnesium carbonate	0.05
Silica	Trace.
Total	216.01

This spring issues from the rock at a depth of 250 feet, and resembles the class known in Germany as muriated (chloride of sodium) alkaline springs. It is somewhat similar to the waters of Vichy, Tachingen, and Bilin, but is more like those of Kissengen, Homburg, and Wiesbaden. The water has a stimulating effect upon the mucous membrane of the stomach and bowels and increases the flow of gastric juice and bile and promotes digestion and absorption. It has about the proper quantity of sodium chloride to favorably influence the process of osmosis. In large doses it is purgative.

NEPTUNE SPRING.

Salinic-calcic. Iodo-bromated.

One U. S. gallon contains:

Solids.	Grains.
Calcium cloride	3,499.08
Magnesium chloride	635.67
Sodium chloride	6,368.33
Sodium iodide	Trace.
Sodium bromide	"
Iron and alumina	"
Total	10,503.08

This water constitutes a strong brine. It is quite remarkable for its large proportion of calcium chloride and its total freedom from calcium sulphate (gypsum). In its principal ingredients it resembles the brine springs of Michigan and the springs of Nauheim, Rehme, and Jaxtfelt. It may be classed as an iodo-bromated saline spring, and while not adapted for drinking purposes, is of great value for bathing. By charging the water with carbonic acid gas it becomes very similar to the Nauheim waters, and the treatment of glandular and rheumatic troubles, gout, lumbago, and sciatica, as well as the Schott method in chronic disease of the heart, is carried out at Glen Springs. This water is also employed in the electro-chemical and electro-vapor baths, douches, sprays, etc. The spring is said to have its origin about 1700 feet below the surface of the earth.

DEER LICK SPRING.

Saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	114.75
Potassium chloride	0.23
Sodium bromide	0.59
Sodium iodide	0.04
Potassium sulphate	Traces.
Lithium bicarbonate	"
Ammonium bicarbonate	1.08
Iron bicarbonate	1.73
Calcium bicarbonate	41.77
Magnesium bicarbonate	19.28
Alumina	0.34
Sodium phosphate	Traces.
Silica	0.64
Total	180.45

This water is clear and sparkling, without odor, and with a slight astringent, mildly saline taste. Containing, as it does, besides chloride of sodium and iron, the rare ingredients of iodine and bromine (in combination), it may be ranked as a ferro-iodo-bromo-muriated spring. It is also rich in carbonic acid gas. It resembles in many respects the waters of Kreuznach, Hall, Duerkheim, and Krauenheit. It is an excellent drinking water, and, unlike many of the foreign iodo-bromated waters, may be taken as it flows without dilution. The Deer Lick water possesses tonic, alterative, diuretic, and mildly aperient properties. Tissue metabolism is promoted and the red globules of the blood increased. Its physiological action fits it for use in anæmia, neurasthenia, chronic renal diseases, glycosuria, and chronic diseases of the uterus.

GREAT BEAR SPRING,

OSWEGO COUNTY.

This spring is located near Fulton. It has been known for many years, having been used by the aborigines. Within the last few years the spring has been improved, and the water has an extensive sale in Syracuse. More recently it has been introduced into New York and other large cities. The water is but feebly mineralized, but it is remarkably pure, and its freedom from organic matter gives it excellent qualities for the table. Its very small cost is an additional advantage. The following analysis was made in 1890 by Dr. William Manlius Smith, of Syracuse:

GREAT BEAR SPRING.

Light-Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	0.72
Calcium carbonate	3.50
Magnesium carbonate	1.25
Magnesium chloride	0.47
Sodium and potassium carbonates	Traces.
Total	5.94

*LEBANON SPRINGS,

COLUMBIA COUNTY.

Post-office, Lebanon Springs. Hotel. Access from Bennington, Vt., or from Chatham, N. Y., *via* Lebanon Springs R. R. The location is in the extreme northeastern corner of Columbia County, one hundred and fifty-five miles north of New York and twenty-five miles northeast of Chatham.

This spring claims our attention as being the only thermal water in the extensive territory embraced by New York and the New England States. The temperature, 75° F., is about the same as the Old Sweet Springs of Virginia. The spring yields about 30,000 gallons hourly. The following analysis was made by Prof. H. Dussance:

LEBANON THERMAL SPRING.

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	2.41
Calcium carbonate	4.04
Potassium sulphate	1.04
Magnesium sulphate	1.06
Sodium chloride	0.96
Sodium sulphide	0.02
Iron oxide	0.94
Alumina	0.45
Silica	3.25
Organic matter	10.21
Total	24.38

Gases.	Cubic inches.
Carbonic acid	0.48
Oxygen	2.00
Nitrogen	3.52

This place has been a well-known resort since pre-Revolutionary days. The salubrity of the climate and the beauty of the scenery tend to make the surroundings very attractive. The water is used principally for bathing. A valuable chalybeate spring is located in the village of the Brickyard Shakers, a short distance from Lebanon Springs.

*MASSENA SPRINGS (OR ST. REGIS SPRINGS),

St. Lawrence County.

Post-office, Massena Springs. Hotel. Access *via* Rochester division of the Rome, Watertown and Ogdensburg R. R., or *via* Massena Springs branch of Grand Trunk R. R. to Massena Springs Station.

This is one of the old-time spring resorts of the Empire State. The springs are delightfully situated on the banks of the Raquette River, a broad and rapid stream flowing into the St. Lawrence. The following analysis was made as long ago as 1850 by Prof. W. J. Craw:

MASSENA SPRINGS.

Saline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Calcium bicarbonate	4.85
Iron bicarbonate	0.49
Sodium hyposulphide	4.21
Sodium sulphate	0.50
Calcium sulphate	60.03
Sodium phosphate	1.32
Sodium chloride	76.79
Potassium chloride	0.51
Magnesium chloride	29.93
Magnesium bromide	0.67
Sodium sulphide	1.40
Organic matter, Silicate of soda,	11.18
Total	191.88

Sulphureted hydrogen gas, 5.30 cubic inches.

This analysis represents what may be expressed as a muriated-calcic-alkaline-sulphureted water, but for ordinary purposes the term saline-sulphureted is sufficient. The water resembles that of Eilsen, in the principality of Schaumburg-Lippe, but is much richer in chloride of sodium. It has been found decidedly useful in dartrous forms of skin disease, renal and vesical calculus, catarrh of the bladder, and other affections. Bathing facilities are ample.

*OAK ORCHARD ACID SPRINGS,

Genesee County.

Post-office, Medina, Orleans County. Access *via* New York Central R. R. to Medina, a station forty miles west of Rochester, thence six miles south by stage.

The springs are not used as a resort, but the waters have been sold to some extent. The following analyses show the waters to possess exceptional properties:

OAK ORCHARD SPRINGS.

Sulphated-acid.

One U. S. gallon contains:	Spring No. 1. Silliman and Norton.	Spring No. 2. E. Emmons.	Oak Orchard Acid Water. Prof. Porter.
Solids.	Grains.	Grains.	Grains.
Sodium sulphate	6.34	...	3.16
Calcium sulphate	74.89	12.41	13.72
Potassium sulphate	5.52	...	2.48
Aluminium sulphate	21.69	...	6.41
Magnesium sulphate	35.60	4.98	8.49
Iron sulphate	...	39.23	...
Iron proto-sulphate	28.62	...	32.22
Sodium chloride	2.44	...	1.43
Silica	4.59	1.84	3.33
Organic matter	...	10.88	6.65
Sulphuric acid	134.73	129.06	133.31
Total	314.42	198.40	211.20

These springs are remarkable in the amount of free sulphuric acid they contain, more, indeed, with one or two exceptions, than any other waters known. Waters containing this acid in free state are exceedingly rare. It is said that none of the kind are known in Europe. Among the few known on this side of the Atlantic are: one in the town of Byron, near the Oak Orchard Spring; the Tuscarora Sour Spring, in Canada; the Matchless Mineral Wells of Alabama, and several acid springs in Texas, California, and Virginia.

According to Prof. J. H. Armsby, of Albany, the Oak Orchard water has been used with advantage in "ill-conditioned ulcers, diseases of the skin, passive hemorrhages, diarrhœas depending upon an atonic condition of the mucous membranes, and in depraved and impoverished conditions of the body from specific disease and from intemperance." The water requires dilution before drinking.

RICHFIELD SPRINGS,

OTSEGO COUNTY.

Post-office, Richfield Springs. Hotels and cottages. From New York through drawing-room cars to Richfield every morning *via* New York Central and Hudson River R. R., also *via* Delaware, Lackawanna and Western R. R. From Philadelphia the morning express *via* Delaware, Lackawanna and Western R. R. arrives at springs in time for dinner. From Washington and Philadelphia *via* Pennsylvania R. R. the traveller can reach Richfield without change of cars, by way of Utica.

This charming summer resort is picturesquely located on Lake Canadarago, at an altitude of 1750 feet above the sea-level Richfield may be classed among the most attractive of our summer resorts. In writing of his visit here, Charles Dudley Warner well and truly said, "the charm of Richfield is in the character of its landscapes." It is scenery "that one grows to love and that responds to one's every mood in variety and beauty. In a whole summer the pedestrian will not exhaust the inspiring views, and the drives over the hills, round the lakes, by woods and farms, increase in interest as one knows them better. The artist is here year after year, one season being too short to satisfy the demands the charms of the region make upon his love of the beautiful." The art of man has added much to the natural attractiveness of the location. The lover of society or amusement finds balls, germans, and hops, with an excellent orchestra; out of doors there are croquet grounds, tennis courts, and a bicycle track, while the hotels furnish ample facilities for billiards, pool, and bowling to beguile the fleeting hours. The greatest attraction of Richfield, however, is found in the fine White Sulphur Springs. There are sixteen springs at this resort, and some of them have become widely celebrated. The bath-house in connection with the springs is one of the most complete in the world, and provides for the therapeutic use of water combined with massage and electricity in a thoroughly scientific manner. It contains sixty-seven sulphur bath-rooms, eight private baths, Turkish and Russian baths, a large swimming pool, a pulverization room, beside inhalation rooms for the treatment of bronchitis and catarrh; electrical rooms, douche rooms, and a sun bath. The bath-house is situated on the grounds directly in front of the Hotel Earlington. The following analysis of the principal spring, known as the White Sulphur Spring, was made by Prof. Chandler, of New York:

WHITE SULPHUR SPRING (RICHFIELD SPRINGS).

Alkaline-calcic. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium hydrosulphate	1.72
Calcium hydrosulphate	0.09
Potassium sulphate	1.67
Calcium sulphate	112.34
Strontium sulphate	0.01
Barium sulphate	Trace.
Magnesium sulphate	5.15
Sodium hyposulphite	0.38
Magnesium bicarbonate	31.74
Iron bicarbonate	Trace.
Calcium phosphate	"
Sodium chloride	0.52
Lithium chloride	0.02
Alumina	Trace.
Silica	0.64
Total	154.28

Sulphureted hydrogen gas, 14.20 cubic inches.

This spring, it will be observed, is very heavily charged with sulphureted hydrogen gas. Other important springs at Richfield are the Iron and Magnesia Springs, besides additional sulphur springs. The drinking waters are obtained from springs west of the village, and are pure and abundant. A course of baths at Richfield has been found of value in cases of insomnia from over-work, nervousness, or anxiety, in stomach disorders resulting from abused digestion, chronic malarial infection, gout, rheumatism, and some of the disorders of the liver and kidneys. The visitor will find in the Hotels Earlington, St. James, and smaller places accommodations to please any taste or exchecquer.

SARATOGA SPRINGS,

SARATOGA COUNTY.

Post-office, Saratoga. Hotels, boarding-houses, and cottages. Access: Saratoga is a station on the Delaware and Hudson R. R., thirty-eight miles north of Albany and 183 miles north of New York. The trip may be made by steamers on the Hudson River to Albany or by two lines of railroad: the New York Central and the West Shore to Albany, thence *via* Delaware and Hudson R. R. Through trains run daily from New York during the season. From Buffalo and the West Saratoga is reached by way of the Delaware and Hudson R. R. and its Western connections, and from Boston and the East *via* the Fitchburg R. R. to Albany, and thence *via* the Delaware and Hudson R. R.

This famous resort is, perhaps, the most celebrated watering-place in the United States, as it is undoubtedly the oldest in the Northern States, and with the exception of Berkeley Springs in Virginia, the oldest in the country. The village is situated toward the eastern border of the State at the southern termination of the Adirondack range of mountains, and about the centre of a valley extending from Ballston to Quaker Springs. The altitude of Saratoga is about 300 feet above the sea level, and the population varies from about 11,000 in the winter to 35,000 during the season, which lasts from the middle of June to the middle of September. The accommodation for visitors of all classes is ample and excellent. Some of the finest summer hotels in the world will be found here, while numerous smaller hotels and many excellent boarding-houses cater to those who wish to live less expensively.

The name Saratoga is derived from the Iroquois tribe of Indians, and there is ample evidence to show that some of the springs here were know to and used by the aborigines many years prior to the advent of the European settlers. The well-known High Rock Spring on Willow Walk, seems to have been the first of these springs used by the whites. It is said to have been resorted to by Sir William Johnson as early as 1767. In 1773 Dirick Scowton cleared a small portion of land on the summit of the hill in the rear of High Rock Spring, and erected a log cabin, the first habitation to be built at Saratoga. The first real impetus given to the resort, however, was in 1789, when Gideon Putnam, of Sutton, appeared at the springs, leased 300 acres of land, and thereafter was the leading spirit of improvement. In 1802 he built a portion of Union Hall upon the site of the present magnificent Grand Union Hotel, and this may be regarded as the starting-point of the Saratoga which we know to-day. Since those days many new springs have been added to the list, and the number at the present time will exceed fifty. As late as May 10, 1897, the New York *Sun* contained an account of a new spring which had been struck at the Geysers on the preceding day by workmen who were drilling for the Carlsbad Company. For eleven minutes after the vein was pierced the water spouted fifteen feet high from a six-inch opening The water of the new spring, which is 283 feet deep, is said to be strongly cathartic.

Saratoga presents many attractions beside the mineral springs and the grand hotels. The village has numerous elegant private residences, densely shaded streets, attractive walks, and beautiful drives. "The grounds of the different fountains are picturesquely adorned and shaded, and each hotel has its embowered court, where pleasing music is discoursed at intervals through the day and evening. Congress Park, at the southern extremity of Broadway, is a favorite resort where during the morning hours, visitors congregate at the spring, drink of the waters, and stroll along the beautiful walks beneath the shade of ancient forest trees" (Walton). Among the numerous attractions in the neighborhood are the Saratoga Lake, nine miles long and four or five miles wide, Prospect or Waring Hill, said to rise 2000 feet above the sea-level, Chapman's Hill, Hagerty Hill, etc. Bemis' Heights, the scene of the surrender of Burgoyne to General Gates, is in the town of Stillwater, fifteen miles distant. All these points and many others may be easily reached from Saratoga by carriage drives or bicycles.

The predominant ingredients of the Saratoga waters, as will be seen from the analyses, are the chloride of sodium, the alkaline carbonates, and carbonic acid gas. Some of them are, furthermore, quite heavily impregnated with iron. All contain one or more of the salts of lime. They are properly described as muriated alkaline-calcic carbonated waters. The further designation of chalybeate may be applied in many instances. We are able to present analyses of twenty-four of the principal springs as follows:

SARATOGA SPRINGS.

Alkaline-saline-carbonated.

Champion Spouting Spring.

(C. F. Chandler.)

One U. S. gallon contains: Solids.	Grains.	One U. S. gallon contains: Solids.	Grains.
Sodium bicarbonate	17.62	Potassium chloride	40.45
Calcium bicarbonate	227.07	Sodium bromide	3.58
Magnesium bicarbonate	193.91	Calcium fluoride	Trace.
Strontium bicarbonate	0.08	Sodium iodide	0.23
Lithium bicarbonate	6.25	Alumina	0.46
Iron bicarbonate	0.65	Silica	0.70
Barium bicarbonate	2.08	Organic matter	Trace.
Potassium sulphate	0.25		
Sodium phosphate	0.01	Total	1195.58
Sodium biborate	Trace.	Carbonic acid gas	465.46
Sodium chloride	702.24		

Columbian Springs.

(J. H. Steele.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	15.40	Sodium iodide	2.56
Calcium carbonate	68.00	Silica	2.05
Magnesium bicarbonate	46.71		
Iron carbonate	5.58	Total	407.30
Sodium chloride	267.00	Atmospheric air	4.50
Potassium bromide	Trace.	Carbonic acid gas	272.06

Crystal Springs.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	10.06	Potassium chloride	8.33
Calcium bicarbonate	101.88	Sodium bromide	0.41
Magnesium bicarbonate	75.16	Calcium fluoride	Trace.
Strontium bicarbonate	Trace.	Sodium iodide	0.06
Lithium bicarbonate.	4.33	Alumina	0.31
Iron bicarbonate	2.04	Silica	3.21
Barium bicarbonate	0.73	Organic matter	Trace.
Potassium sulphate	2.16		
Sodium phosphate	Trace.	Total	537.15
Sodium biborate	“	Carbonic acid gas	317.45
Sodium chloride	328.47		

Congress Spring.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	10.77	Sodium chloride	400.44
Calcium bicarbonate	143.40	Potassium chloride	8.05
Magnesium bicarbonate	121.76	Sodium bromide	8.56
Strontium bicarbonate	Trace.	Calcium fluoride	Trace.
Lithium bicarbonate	4.76	Sodium iodide	0.14
Iron bicarbonate	0.34	Alumina	Trace.
Barium bicarbonate	0.93	Silica	0.84
Potassium sulphate	0.89		
Sodium phosphate	0.02	Total	700.90
Sodium biborate	Trace.	Carbonic acid gas	392.30

SARATOGA SPRINGS—*Continued.*

Empire Spring.

(C. F. Chandler.)

One U. S. gallon contains: Solids.	Grains.	One U. S. gallon contains: Solids.	Grains.
Sodium bicarbonate	9.02	Potassium chloride	4.29
Calcium bicarbonate	109.66	Sodium bromide	0.27
Magnesium bicarbonate	42.96	Calcium fluoride	Trace.
Strontium bicarbonate	Trace.	Sodium iodide	“
Lithium bicarbonate	2.08	Alumina	0.42
Iron bicarbonate	0.79	Silica	1.46
Barium bicarbonate	0.07	Organic matter	Trace.
Potassium sulphate	2.77		
Sodium phosphate	0.02	Total	680.44
Sodium biborate	Trace.	Carbonic acid gas	344.67
Sodium chloride	506.63		

Eureka Spring.

(Prof. Allen.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	8.75	Sodium iodide	4.67
Calcium bicarbonate	41.32	Alumina	0.23
Magnesium bicarbonate	29.34	Silica	0.53
Iron bicarbonate	3.00		
Magnesium sulphate	2.15	Total	258.37
Sodium chloride	166.81	Carbonic acid gas	239.00
Potassium bromide	1.57		

Excelsior Spring.

(Prof. Allen.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	15.00	Potassium bromide	Trace.
Calcium bicarbonate	77.00	Sodium iodide	4.24
Magnesium bicarbonate	32.33	Sodium silicate	4.00
Iron bicarbonate	3.22	Potassium silicate	7.00
Sodium sulphate	1.32		
Strontium sulphate	Trace.	Total	514.75
Sodium chloride	370.64	Carbonic acid gas	250.00

Flat Rock Spring.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	9.10	Sodium chloride	108.85
Calcium bicarbonate	98.63	Potassium chloride	7.99
Magnesium bicarbonate	29.47	Magnesium chloride	10.83
Strontium bicarbonate	0.01	Sodium bromide	0.32
Lithium bicarbonate	3.23	Sodium iodide	0.01
Iron bicarbonate	0.09	Alumina	0.04
Barium bicarbonate	0.10	Silica	1.34
Potassium sulphate	0.48	Organic matter	Trace.
Sodium phosphate	0.04		
Sodium biborate	Trace.	Total	270.53

SARATOGA SPRINGS—*Continued.*

Geyser Spouting Spring.

(J. H. Steele.)

One U. S. gallon contains: Solids.	Grains.	One U. S. gallon contains: Solids.	Grains.
Sodium bicarbonate	71.23	Potassium chloride	24.64
Calcium bicarbonate	168.39	Sodium bromide	2.21
Magnesium bicarbonate	149.34	Calcium fluoride	Trace.
Strontium bicarbonate	0.43	Sodium iodide	0.25
Lithium bicarbonate	9.00	Alumina	Trace.
Iron bicarbonate	0.98	Silica	0.66
Barium bicarbonate	2.01	Organic matter	Trace.
Potassium sulphate	0.32		
Sodium phosphate	Trace.	Total	991.54
Sodium biborate	“	Carbonic acid gas	454.08
Sodium chloride	562.08		

Hamilton Spring.

(Prof. Allen.)

Solids.	Grains.	Solids.	Grains.
Sodium carbonate	34.25	Sodium iodide	3.59
Calcium carbonate	97.99	Silica	1.00
Magnesium carbonate	39.06		
Iron carbonate	4.62	Total	479.17
Sodium chloride	298.66	Carbonic acid gas	320.00

Hathorn Spring.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	4.29	Potassium chloride	9.60
Calcium bicarbonate	170.65	Sodium bromide	1.53
Magnesium bicarbonate	176.46	Calcium fluoride	Trace.
Strontium bicarbonate	Trace.	Sodium iodide	0.19
Lithium bicarbonate	11.45	Alumina	0.13
Iron bicarbonate	1.13	Silica	1.26
Barium bicarbonate	1.74	Organic matter	Trace.
Sodium phosphate	Trace.		
Sodium biborate	“	Total	888.40
Sodium chloride	509.97	Carbonic acid gas	375.75

High Rock Spring.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	34.89	Sodium bromide	0.73
Calcium bicarbonate	131.74	Calcium fluoride	Trace.
Magnesium bicarbonate	54.92	Sodium iodide	0.08
Strontium bicarbonate	Trace.	Alumina	1.22
Iron bicarbonate	1.48	Silica	2.26
Barium bicarbonate	Trace.	Organic matter	Trace.
Potassium sulphate	1.61		
Calcium phosphate	Trace.	Total	627.56
Sodium chloride	390.13	Carbonic acid gas	409.46
Potassium chloride	8.50		

SARATOGA SPRINGS—*Continued.*

Kissingen or Triton Spring.

(Prof. Sharples.)

One U. S. gallon contains: Solids.	Grains.	One U. S. gallon contains: Solids.	Grains.
Sodium bicarbonate	67.62	Potassium chloride	16.98
Calcium bicarbonate	140.26	Sodium bromide	1.80
Magnesium bicarbonate	70.47	Calcium fluoride	Trace.
Strontium bicarbonate	Trace.	Sodium iodide	0.04
Lithium bicarbonate	5.13	Alumina	Trace.
Iron bicarbonate	1.56	Silica	1.28
Barium bicarbonate	0.99		
Potassium sulphate	Trace.	Total	644.63
Sodium chloride	338.50	Carbonic acid gas	361.50

Pavilion Spring.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	3.76	Potassium chloride	7.66
Calcium bicarbonate	120.17	Sodium bromide	0.99
Magnesium bicarbonate	76.27	Calcium fluoride	Trace.
Strontium bicarbonate	Trace.	Sodium iodide	0.07
Lithium bicarbonate	9.49	Alumina	0.33
Iron bicarbonate	2.57	Silica	3.16
Barium bicarbonate	0.88	Organic matter	Trace.
Potassium sulphate	2.03		
Sodium phosphate	Trace.	Total	687.28
Sodium biborate	“	Carbonic acid gas	332.46
Sodium chloride	459.90		

Putnam Spring.

(J. R. Chilton.)

Solids.	Grains.	Solids,	Grains.
Sodium bicarbonate	14.32	Sodium iodide	2.00
Calcium bicarbonate	68.80	Alumina	0.56
Magnesium bicarbonate	51.60	Silica	0.84
Iron bicarbonate	7.00		
Sodium sulphate	1.68	Total	361.01
Sodium phosphate	0.21	Carbonic acid gas	326.40
Sodium chloride	214.00	Atmospheric air	6.40
Potassium bromide	Trace.		

New Putnam Spring.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	8.08	Sodium chloride	268.04
Calcium bicarbonate	157.56	Potassium chloride	14.87
Magnesium bicarbonate	173.61	Sodium bromide	1.62
Strontium bicarbonate	0.11	Calcium fluoride	Trace.
Lithium bicarbonate	9.83	Sodium iodide	“
Iron bicarbonate	0.45	Alumina	0.22
Barium bicarbonate	0.38	Silica	3.00
Potassium sulphate	2.26	Organic matter	Trace.
Sodium phosphate	Trace.		
Sodium biborate	“	Total	640.03

SARATOGA SPRINGS—*Continued.*

Red Spring.

(Prof. Appleton.)

One U. S. gallon contains:

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	15.33	Potassium chloride	6.86
Calcium bicarbonate	101.26	Iron oxide,	2.10
Magnesium bicarbonate	42.41	Alumina,	
Strontium bicarbonate	Trace.	Silica	3.25
Lithium bicarbonate	0.94		
Sodium chloride	83.53	Total	255.68

Saratoga A or Alum Spring.

(J. G. Pohle.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	6.75	Calcium chloride	Trace.
Calcium bicarbonate	56.85	Potassium chloride	0.36
Magnesium bicarbonate	20.48	Magnesium chloride	Trace.
Lithium bicarbonate	1.72	Alumina	0.38
Iron bicarbonate	1.72	Silica	1.46
Sodium sulphate	2.50	Organic matter	Trace.
Calcium sulphate	0.45		
Potassium sulphate	0.37	Total	658.63
Magnesium sulphate	0.29	Carbonic acid gas	212.00
Sodium chloride	565.30		

Seltzer Spring.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	29.43	Potassium chloride	1.34
Calcium bicarbonate	89.87	Sodium bromide	0.63
Magnesium bicarbonate	40.34	Calcium fluoride	Trace.
Strontium bicarbonate	Trace.	Sodium iodide	0.03
Lithium bicarbonate	0.90	Boric acid	Trace.
Iron bicarbonate	1.70	Alumina	0.37
Barium bicarbonate	Trace.	Silica	2.56
Potassium sulphate	0.56	Organic matter	Trace.
Sodium phosphate	Trace.		
Calcium phosphate	“	Total	302.02
Sodium biborate	“	Carbonic acid gas	324.08
Sodium chloride	134.29		

Star Spring.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	12.66	Potassium chloride	9.70
Calcium bicarbonate	124.46	Sodium bromide	0.57
Magnesium bicarbonate	61.91	Calcium fluoride	Trace.
Strontium bicarbonate	Trace.	Sodium iodide	0.13
Lithium bicarbonate	1.50	Alumina	Trace.
Iron bicarbonate	1.21	Silica	1.28
Barium bicarbonate	0.10	Organic matter	Trace.
Potassium sulphate	5.40		
Sodium phosphate	Trace.	Total	617.37
Sodium biborate	“	Carbonic acid gas	407.65
Sodium chloride	398.36		

SARATOGA SPRINGS—*Continued.*

Union Spring.

(C. F. Chandler.)

One U. S. gallon contains: Solids.	Grains.	One U. S. gallon contains: Solids.	Grains.
Sodium bicarbonate	17.01	Potassium chloride	8.73
Calcium bicarbonate	96.70	Sodium bromide	1.30
Magnesium bicarbonate	109.69	Calcium fluoride	Trace.
Strontium bicarbonate	Trace.	Sodium iodide	0.04
Lithium bicarbonate	2.61	Alumina	0.32
Iron bicarbonate	0.27	Silica	2.65
Barium bicarbonate	1.70	Organic matter	Trace.
Potassium sulphate	1.82		
Sodium phosphate	0.03	Total	696.17
Sodium biborate	Trace.	Carbonic acid gas	384.97
Sodium chloride	453.30		

United States Spring.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	4.67	Potassium chloride	8.62
Calcium bicarbonate	93.12	Sodium bromide	0.84
Magnesium bicarbonate	72.88	Calcium fluoride	Trace.
Strontium bicarbonate	0.02	Sodium iodide	0.05
Lithium bicarbonate	4.85	Alumina	0.09
Iron bicarbonate	0.71	Silica	3.19
Barium bicarbonate	0.91	Organic matter	Trace.
Sodium phosphate	0.02		
Potassium sulphate	Trace.	Total	331.84
Sodium chloride	141.87	Carbonic acid gas	245.73

Vichy Spring.

(C. F. Chandler.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	82.87	Potassium chloride	14.11
Calcium bicarbonate	95.52	Sodium bromide	0.99
Magnesium bicarbonate	41.50	Calcium fluoride	Trace.
Strontium bicarbonate	Trace.	Sodium iodide	"
Lithium bicarbonate	1.76	Alumina	0.48
Iron bicarbonate	0.05	Silica	0.76
Barium bicarbonate	0.59	Organic matter	Trace.
Potassium sulphate	Trace.		
Sodium phosphate	"	Total	367.32
Sodium biborate	"	Carbonic acid gas	383.07
Sodium chloride	128.69		

Washington Spring.

(J. R. Chilton.)

Solids.	Grains.	Solids.	Grains.
Sodium bicarbonate	8.48	Potassium bromide	0.47
Calcium bicarbonate	84.10	Sodium iodide	2.24
Magnesium bicarbonate	65.97	Alumina	Trace.
Iron bicarbonate	3.80	Silica	1.50
Magnesium sulphate	0.05		
Sodium chloride	182.73	Total	350.22
Calcium chloride	0.20	Carbonic acid gas	363.77
Magnesium chloride	0.68		

Some of the analyses were made many years ago, and a re-examination is desirable. It will be observed that all the waters contain large quantities of carbonic acid gas, ranging from about 212 cubic inches per United States gallon in the Saratoga Alum Spring to 465 cubic inches in the Champion Spouting Spring. All contain the chloride of sodium and potassium, the former salt ranging from 702 grains per United States gallon in the Champion Spring to 108 grains in the Flat Rock Spring. The bicarbonate of sodium is also present in each of the springs, the Vichy Spring leading with 82 grains and the Kissingen following with 67 grains per gallon. All contain magnesium salts, the Champion spring being first with 193 grains of magnesium bicarbonate per United States gallon. All the springs analyzed according to the more recent methods of examination, are found to contain lithium, the Hathorn having 11 grains and the Geyser, Pavilion, and New Putnam Springs each about 9 grains of the bicarbonate to the United States gallon. Most of the other springs contain an appreciable amount of lithium. Iron is also present in all of the waters, from the merest trace in some to 4.62 grains per gallon in the Hamilton, 5.88 grains in the Columbian, and 7 grains in the Putnam Springs. All of the springs also contain calcium, while many of them contain the iodide and the bromide of sodium. The Putnam Spring contains the bicarbonate of magnesium. Several well-known springs are not included in the above list, among them being the Lafayette, Carlsbad, Patterson, Royal, and Peerless Recent analyses of these springs show that they possess the general characteristics of the Saratoga waters previously examined.[1]

It will thus be seen that the Saratoga waters will rank among the most potent of their class to be found on the globe. Such being the case, they have been recommended in a wide range of disorders and diseases, in many of which they have been found useful, while in others their influence has been pernicious. It can be laid down as an axiom that waters of this strength should not be taken at random; the consumer should invariably give himself the benefit of the advice of a physician of skill and experience before entering upon a course of the waters, either in his own home or at the springs.[2] We cannot in this place enter into a detailed discussion as to the indications and contraindications for the Saratoga waters, but it may be said in a general way that their best application has been found in dyspepsia, engorgement of the liver and portal system, and chronic constipation. The chalybeate waters have been found beneficial as a tonic and reconstructive in general debility, neurasthenia, and in anæmic states. The springs containing lithia may be counted upon to exercise the same influence upon the protean uric-acid states as that of the widely-advertised lithia waters.

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[1] Irwin. Op. cit.

[2] Vide chapter on Therapeutics.

Many of the waters also possess a very appreciable alterative effect when taken for a considerable period of time.

There are three bathing establishments at Saratoga: the Saratoga Baths, recently opened and luxuriously appointed; the Red Spring Bath-house, and the misnamed Magnetic Baths. There is also a bath-house at the White Sulphur Spring south of Saratoga Lake. All are well conducted.

SHARON SPRINGS,

Schoharie County.

Post-office, Sharon Springs. Hotels, boarding-houses, and cottages. Access *via* Albany and Susquehanna R. R. direct to the springs; also *via* New York Central R. R. to Palatine Bridge, and thence by stage nine miles to springs.

The village of Sharon Springs is situated in a valley about 1100 feet above the sea-level; the streets are provided with good sidewalks, and are well shaded with maple trees. The air is pure and bracing and free from malarial influences. Even in the warmest of summer weather the nights are cool and pleasant for sleeping. The springs are easy of access within the village limits on the edge of a natural forest abounding in pleasant walks. The surrounding country is hilly and affords interesting drives and pleasant scenery. Excellent accommodations may be obtained in the village, conformable to any taste or grade of expenditure. Sharon is one of the well-established old resorts of New York State, its waters having been used for medicinal purposes since early in the present century. The old bathing buildings were destroyed by fire a few years ago and have been replaced by the present spacious establishment, believed to be unexcelled for its purposes anywhere in the country. There are several valuable springs at Sharon, the most important being the White Sulphur, the Magnesia, and the so-called Eye-water Spring. The waters of the White Sulphur Spring are used both internally and for bathing purposes. It is clear and bright as it issues from the spring, of an agreeable temperature for drinking (48° F.), and free of the roughness and acerbity which so often characterize sulphur waters. It is conducted to the bath-house and heated to any desired temperature for bathing. This spring yields 1400 or 1500 gallons of water per hour, so that the supply is always fresh and abundant. The Magnesia Spring is also valuable for drinking purposes. The third spring is used extensively as a lotion for inflammatory conditions of the eye, which fact has led to its designation of the Eye-water Spring. A chalybeate spring is also found within the village limits. The following analyses of three of the springs were made a number of years ago:

SHARON SPRINGS.

Saline-calcic. . Sulphureted.

One U. S. gallon contains:	White Sulphur Spring. Lawrence Reid.	Gardner Magnesia Spring. J. G. Pohle.	Eye-water Spring. Lawrence Reid.
Solids.	Grains.	Grains.	Grains.
Sodium bicarbonate	...	0.54	...
Calcium bicarbonate	...	9.70	...
Magnesium bicarbonate	24.00	1.36	32.00
Calcium sulphate	85.40	93.50	77.50
Magnesium sulphate	34.00	19.68	7.50
Sodium chloride,	2.70	1.23	2.50
Magnesium chloride,		0.44	
Calcium chloride	...	0.16	...
Calcium sulphide,	3.00	0.63	...
Magnesium sulphide,			
Silica	...	0.40	...
Total	149.10	127.64	119.50
Gases.	Cubic ins.	Cubic ins.	Cubic ins.
Sulphureted hydrogen	20.50	6.00	...
Carbonic acid	...	2.22	...
Atmospheric air	...	3.00	...

The sulphur baths here have a wide reputation in the treatment of gout, rheumatism, and certain forms of paralysis. They are also serviceable in cases where exudations are to be absorbed — *e. g.*, in old gunshot wounds, stiff joints, glandular enlargements, etc.

It is said that many of the consequences of high living, such as congestion of the liver, abdominal plethora, and hemorrhoids, are quite certain to yield to a course of the Sharon waters. They are useful also in metallic poisoning and in ridding the system of chronic syphilitic infection, etc. The methods of employing sulphur waters at the well-known French spas, Aix-les-Bains, Challes, and Allevard, were adopted at Sharon Springs in 1884, and have been in successful operation since that time. The sulphur water of Sharon is also used commercially.

SLATERVILLE MAGNETIC SPRINGS,

TOMPKINS COUNTY.

Post-office, Slaterville. Hotels. Access: The springs are accessible from Bessemer, on the Elmira, Central and Northern R. R. from Richford or Harford on the Southern Central R. R., and from Caroline Station (three and a half miles from the springs) on the Delaware, Lackawanna, and Western R. R. Carriages will meet intending visitors at any of the above points on application.

This resort is located in a charming valley surrounded by rugged hills. It is eight miles from Ithaca, and has an elevation of 2100 feet above tide-water. The region in the neighborhood of Slaterville is one of great beauty and grandeur, affording delightful drives and numerous opportunities for pleasant excursions. The following points are within easy distance: Watkins Glen, Tanghannock, Enfield, Buttermilk Falls, and Cayuga and Dryden Lakes. There are excellent trout fishing and hunting in the vicinity during the season.

The springs are four in number and flow from 300 to 420 gallons of water per hour. The following qualitative analysis was made by State Assayer Charles T. Jackson, M.D., of Massachusetts:

SLATERVILLE SPRINGS.

Solids.	Solids.
Calcium carbonate.	Magnesium chlorate. (?)
Iron carbonate.	Potassium nitrate.
Sodium sulphate.	Calcium chlorate. (?)
Calcium sulphate.	

A complete qualitative analysis is desirable. We are unable to classify the springs by the above ingredients. The waters are said to be useful in debility, anæmia, dyspepsia, bladder troubles. Hot and cold baths are supplied to those who desire them. The waters are also used commercially.

The following additional springs of New York are also used as resorts:

Cairo White Sulphur Springs, Cairo, Greene County.

Cayuga Mineral Springs, near Cayuga, Cayuga County.

Chlorine Springs, Syracuse, Onondaga County. Saline.

Crystal Springs, Crystal Springs, Yates County.

Dansville Springs, Dansville, Livingston County. Alkaline-calcic.

Darien Mineral Springs, Darien Centre, Genesee County. Acid.

Diamond Rock Mineral Well, Williamson, Wayne County. Sulpho-saline.

Excelsior Spring, Syracuse, Onondaga County. Saline.

Florida Springs, Florida Township, Montgomery County.

Franklin Springs, Cowlesville, Wyoming County. Sulphureted.

Nunda Mineral Springs, Nunda, Livingston County.

Reid's Mineral Spring, South Argyle, Washington County.

Spencer Springs, Spencer, Tioga County.

Verona Mineral Springs, near Verona, Oneida County.

Victor Spring, Darien Centre, Genessee County. Acid-saline.

The following are used commercially: Boonville Mineral Springs, Boonville, Oneida County; Table Rock Mineral Spring, Honeoye Falls, Monroe County.

NORTH CAROLINA.

The limits of this State extend from 33° 53′ to 36° 33′ north latitude, and from 75° 25′ to 84° 30′ west longitude. The extreme length of the State from east to west is 490 miles, while its breadth from north to south is 185 miles. The coast and swamp-land of the State extends nearly 100 miles inland. It is level and abounds in bogs and marshes, the streams being sluggish and muddy. Fully 300,000 acres of the State are covered by swamps. The coast line is nearly 400 miles long, and along its entire course are sandy, desert islands from one-half to two miles wide, separated by numerous inlets, few of which are navigable. Cape Hatteras forms the headland of the dangerous triangular island beach which separates Pamlico Sound from the ocean. Narrow, shallow lagoons filled with constantly shifting sand-bars extend all along the coast south of Cape Lookout between the mainland and the sand islands. In the northeastern part of the State are two extensive sounds—Pamlico and Albemarle, and a smaller one, Currituck—which are cut off from the ocean by the islands or sand-banks referred to. The middle section of North Carolina is fertile and possesses great mineral wealth and abounds in streams, affording extensive water power. Immediately beyond is an elevated region from 1000 to 2000 feet above the sea-level, and still beyond this plateau the main ridge of the Appalachian Mountains traverse the State from northeast to southwest, reaching here its greatest altitude in Mt. Mitchell (6700 feet), the loftiest summit east of the Mississippi River. The Iron or Smoky Mountains, with spurs and cross-chains, lead off in all directions. This mountain range separates the State from Tennessee. Between these two ridges is a plateau whose altitude ranges from 3500 to 4000 feet, being the highest plateau of the same extent east of the Rocky Mountains. This mountain region presents scenery of sublime and lofty grandeur. The rivers of North Carolina are numerous, but have shifting sand-bars at their mouths, and rapids in their descent from the hilly region. The principal streams flowing into the Atlantic are the Cape Fear, Roanoke, Neuse, Tar, Chowan, Yadkin, and Catawba. From the western slope of the Blue Ridge flow the New, Little Tennessee, and other streams, the waters of which breaking through the Iron or Smoky Mountains, join those of the Ohio and Mississippi Rivers. The forest trees of the North Carolina uplands are the oak, ash, hickory, walnut, and lime. The pine, cedar, cypress, maple, oak, and poplar abound in the low country and swamps. The climate of the State varies much. In the elevated portions the atmosphere is cool, dry, bracing, and remarkably healthy. Along the coast it is warm and humid, and malarial diseases are frequent. The mean annual temperature is 58.52° F.; that of the summer, 77.24° F., and of the winter 40.14° F. The average annual rainfall is about 43 inches. The mortality-rate, as computed from the last United States census, was 11.38 per 1000 of population; consumption mortality-rate, 1.37 per 1000.

North Carolina possesses a large number of mineral springs, some of which are still in an undeveloped state. Sulphureted and chalybeate waters are most numerous, as in Virginia and other States along the Appalachian chain. In the Hot Springs of Madison County the State possesses, after the Arkansas Hot Springs, the most highly thermal waters east of the Rocky Mountains. The following account of the North Carolina springs is derived to some extent from Peale's list, from the report of Prof. Charles W. Dabney, Jr., of the State Agricultural Experiment Station, and from Prof. Kerr's report on the geology of North Carolina, but chiefly from correspondence with physicians and others in the State.

ALL-HEALING SPRINGS,

ALEXANDER COUNTY.

Post-office, Taylorsville. Hotel and cottages. Access from Charlotte *via* Charlotte and Taylorsville branch of the Southern Railroad to Taylorsville, fifty-four miles northwest; thence by stage six miles west to springs.

The location of these springs is along the foothills of the Brushy Mountains at an altitude of about 1300 feet above tide-water. The climate in this region is healthy and fairly pleasant at all times. The seasons change gradually, and the temperature seldom reaches extremes either of heat or of cold. The scenery in the vicinity is very pleasing. The following analysis of the springs was made by Dr. Venable, Professor of Chemistry in the State University, in 1895:

ALL-HEALING SPRINGS.

Alkaline-calcic. Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	0.047
Potassium carbonate	0.588
Sodium chloride	0.193
Iron carbonate	0.052
Calcium bicarbonate	4.245
Magnesium bicarbonate	0.051
Potassium phosphate	Trace.
Silica	1.660
Organic matter	Trace.
Total	6.836

The water flows at the rate of about 120 gallons per hour. The water is not strongly mineralized, but it has been found quite beneficial in rheumatic affections of the joints, muscles and skin and in some of the disorders of the blood and kidneys.

BARIUM SPRINGS,

IREDELL COUNTY.

Post-office, Barium Springs. Farm houses. Access *via* A. T. & O. R. R. (Southern System) to Barium Springs Station, thence one-half mile to springs. The location is five miles from Statesville and forty miles from Charlotte.

This spring was discovered about the year 1775. It was formerly known as "Poison" Spring, from the fact that cattle refused to drink it. The spring is located on the top of a rocky knoll, about fifteen feet higher than a brook not over forty feet distant, and eight to ten feet higher than eight other springs around the base of the knoll and over one hundred feet distant. It has no visible outlet, yet the water remains at a constant level, never freezing and never stagnating. According to an analysis by Prof. Ledoux, it contains 17 Troy grains per United States gallon of barium sulphate and chloride, phosphoric acid, and iron. The analysis of Prof. Chandler shows the presence also of a small quantity of sulphuric acid, lime salts, and magnesia.[1] Barium has been recommended as a deobstruent and anthelmintic. Its virtues have been extolled by Dr. Crawford in the treatment of irritable states of the lymphatic system. He thus recommends it in scrofulous affections of delicate structures, like the eyes, lungs, etc. The Barium Springs water is used commercially, and is said to possess value in the early development of cancer, in syphilis, eczema, indigestion, ulceration of the stomach, etc.

BLACKWELL'S WHITE SULPHUR SPRINGS,

BUNCOMBE COUNTY.

Post-office, Alexander. Hotel and cottages. Access *via* Western North Carolina R. R. to Alexander Station; thence four miles west to springs by stage. The location of the springs is twelve miles northwest of Asheville, in the "Land of the Sky," this being one of the highest ranges of the Appalachian chain of mountains. The elevation is 2300 feet above tide-water. Some of the neighboring peaks attain an altitude of from 5000 to 6000 feet. This mountain region is justly celebrated for its salubrious climate and scenery. The springs are usually visited by Northern people from December to June, while the Southerners come from May to November.

The springs are two in number, a sulphur and a chalybeate spring. No analyses have been made. The temperature of the sulphur spring is 48° F., and it flows from 700 to 800 gallons per day of twenty-four hours. A good bath-house is located near this spring, and conveniences for hot and cold sulphur baths are provided. The natural advantages of Blackwell's Springs make the resort a very attractive place for seekers after health or recreation.

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[1] We have been unable to secure the full analyses.

BROMINE–ARSENIC SPRINGS,

ASHE COUNTY.

Post-office, Crumpler. Hotel. Access *via* Norfolk and Western R. R. to Chilhowie, Va., thence thirty-nine miles by stage to the springs; also by private conveyance from Bristol, Tenn., thirty-four miles west.

This spring was discovered in 1885. Since that time it has come into extensive use, and its waters are widely sold. The location of the spring is in a mountainous district, 2725 feet above the sea-level. There is a hotel with accommodations for about one hundred persons at the resort. The spring flows about 60 gallons hourly. The following analysis was made by Prof. Henry Froehling:

THOMPSON'S BROMINE–ARSENIC SPRING.

Alkaline.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	1.04
Calcium carbonate	0.93
Magnesium carbonate	0.62
Lithium carbonate	0.03
Copper carbonate	Trace.
Zinc carbonate	"
Calcium fluoride	"
Potassium sulphate	0.62
Potassium chloride	0.21
Sodium chloride	0.65
Sodium arseniate	Trace.
Sodium iodide	"
Sodium bromide	0.04
Sodium borate	Trace.
Aluminium phosphate	0.12
Iron sulphate	0.08
Silica	1.08
Organic matter	0.03
Total	5.45

The water is unique in possessing recognizable quantities of copper and zinc. It also contains the somewhat rare ingredients of arseniate of sodium and the iodide and bromide of sodium. We also find an appreciable amount of carbonate of lithium and sulphate of iron. The water is not highly mineralized, but it possesses valuable qualities as a mild antacid, tonic, and alterative. It is useful in many of the affections benefited by this class of waters.

HAYWOOD WHITE SULPHUR SPRINGS,

HAYWOOD COUNTY.

Post-office, Waynesville. Hotel and cottages. Access from Asheville *via* Murphy branch of the Western North Carolina R. R., thirty miles west.

The location of these springs is in the heart of the Alleghanies at the foot of the Great Balsam Mountains, where the peaks tower from 5000 to 6000 feet in height. The altitude at the springs is about 2850 feet. The surrounding scenery is of surpassing beauty, not excelled in rugged grandeur east of the Rockies. During the summer and autumn seasons the weather here is generally delightful, the temperature ranging from 56° to 80° F. The hotel is usually crowded with visitors at these times, some of them from remote points. There are two springs, one sulphur, the other iron. The temperature of the water is 54° F. No complete analysis has been made, but we are informed that the waters contain, beside sulphur and iron, salts of sodium, potassium, and magnesium. The present hotel, a large and commodious brick building, with surrounding wooden cottages, is located on the banks of the Richland River, a beautiful trout stream. Numerous attractions in the way of shooting, fishing, archery, tennis, bowling, and billiards are at the option of the guests. The medical properties of the water have been amply attested, especially in chronic functional disturbances of the liver, stomach, and kidneys. Rheumatic and neuralgic troubles are benefited by the hot baths.

HOT SPRINGS,

MADISON COUNTY.

Post-office, Hot Springs. Mountain Park Hotel and boarding-houses. Access from the North and East by through Pullman cars on the Pennsylvania and Southern Railroads; from the West and Northwest *via* Louisville, or *via* Cincinnati by the Queen and Crescent route to Knoxville, thence by East Tennessee, Virginia, and Georgia R. R. (now a part of the Southern System.) The location is thirty-five miles west of Asheville.

The picturesque little village of Hot Springs is situated on the western boundary of North Carolina, only three miles from the Tennessee line, in the heart of the Big Smoky and Blue Ridge Mountains, on the banks of the beautiful French Broad River. The location is 1700 or 1800 feet above the sea-level. The atmosphere is dry and invigorating, and the climate mild and equable, there being a very large proportion of clear days. The springs have long been popular in the South, but in recent years they have come into high favor with Northern visitors also. Guests are received at all times of the year. The Mountain Park Hotel is conducted on strictly first-class principles, and the visitor will find in its appointments all the comforts and conveniences of a desirable home. The springs here are about twenty in number, and the temperature of the waters ranges from 96° to 104° F. They form one of the only two groups of hot springs east of the Mississippi from Canada to the Gulf of Mexico. The following analysis was recently made by Professors Chandler and Pellew, of New York:

NORTH CAROLINA HOT SPRINGS.

Alkaline-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	1.08
Potassium chloride	0.62
Potassium sulphate	1.62
Calcium sulphate	20.04
Magnesium sulphate	7.20
Ammonium bicarbonate	Traces.
Calcium bicarbonate	9.02
Iron bicarbonate	0.10
Sodium phosphate	Traces.
Alumina	0.04
Silica	3.14
Organic and volatile matter	Traces.
Total	42.86

The waters are quite similar to those of the Arkansas Hot Springs. Several of the springs have been encompassed in the limits of a fine, large bath-house, which is divided into sixteen separate pools, nine feet long by six feet wide, and four to five feet in depth. The water pours into these pools directly from the springs. The visitor will find here all of the modern appliances and improvements which go to make up a first-class bathing establishment of the day. With its lovely mountain scenery, its exhilarating climate, its thermal waters, and many other natural attractions, combined with a hospitable and scientific management, this resort is well deserving of the wide reputation which it has obtained.

LEMON SPRINGS,

MOORE COUNTY.

Post-office, Lemon Springs. Access *via* Seaboard Air Line R. R. to Lemon Springs Station, thence a little over two miles to springs. These springs were named for the former owner, the late Dr. M. Lemon. They are located in a fine, healthy region, about 500 feet above the sea-level. The hotel was destroyed by fire a few years since, and the resort is suffering from undue neglect. It is said that the place could be made one of great attractiveness, both for summer and winter visitors. The waters of Spring No. 1 were analyzed by Prof. Ledoux, at that time the State chemist, who detected salts of iron, aluminium, magnesium, and other ingredients in nearly the same proportion as exist in the Buffalo Lithia waters of Virginia.

MT. VERNON SPRINGS,

CHATHAM COUNTY.

Post-office, Mt. Vernon Springs. Hotel. Access from Greensboro or Fayetteville *via* Cape Fear R. R. to Ore Hill Station, thence one mile to springs.

This resort is in a charming spot for those who seek a quiet place for rest and recreation. The location is one of great natural beauty; the elevation above the sea is considerable, and the air is pure and invigorating. The hotel is large and comfortable, and contains 500 feet of piazzas. A dense oak forest surrounds the premises, and beautiful shady walks and drives extend in every direction. The following analysis of Spring No. 3 was made in 1891 by H. B. Battle, Ph.D., Director of the North Carolina Agricultural Experiment Station:

SPRING NO. 3 (MT. VERNON SPRINGS).

Calcic-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	0.15
Potassium chloride	0.86
Sodium chloride	0.27
Sodium carbonate	0.62
Calcium carbonate	1.05
Magnesium carbonate	0.57
Silica	0.59
Iron and aluminium oxide	0.82
Volatile and organic matter and loss	6.64
Total	11.57

The three other springs contain respectively 28.2, 28.1, and 58.3 grains per United States gallon of essentially the same ingredients. An exact quantitative determination of the different salts has, however, not been made. The water is clear, sparkling, and very palatable. It is actively diuretic, and will be found useful in the class of cases benefited by such waters.

PARK'S SPRINGS,

CASWELL COUNTY.

Post-office, Pelham. These springs are located six miles east of Pelham, but do not seem to be used much as a resort. The waters, however, are used commercially, and are highly recommended by physicians of North Carolina and the neighboring States in chronic constipation, dyspepsia, and portal congestion. The following analysis was recently made by Prof. Albert R. Ledoux, Ph.D., of the State Agricultural Experiment Station at Chapel Hill:

PARK'S SPRINGS.

Sulphated-saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	1.50
Sodium sulphate	1.48
Iron oxide	3.50
Alumina	3.50
Uncombined sulphur	0.15
Calcium carbonate	4.80
Silica	Trace.
Sodium chloride	"
Total	14.93

The water bears some resemblance to the well-known Hunyadi-Janos Water of Hungary.

PANACEA SPRINGS,

HALIFAX COUNTY.

Post-office, Littleton. Access:

These springs are situated three and a half miles from the town of Littleton, at an altitude of 380 feet above the sea-level. The location is in a beautiful valley surrounded by picturesque hills covered with rocks of immense size, and still clothed in their primeval forest growth of gigantic oaks. The meteorological conditions which prevail here are of a salutary character, there being neither long droughts nor excessive rains. The springs are fifteen or twenty in number, and flow about 500 gallons of water per hour. The following analysis was made some years ago by Dr. H. B. Battle, of the State Experiment Station. The bases and acids only are given:

PANACEA SPRINGS.

Alkaline-saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Iron (FeO_3)	2.18
Alumina (Al_2O_3)	0.32
Calcium (Ca)	1.11
Magnesium (Mg)	0.20
Manganese (Mn)	0.01
Potassium (K_2C)	0.70
Sodium (Na_2CO_3)	2.23
Hydrochloric acid (HCl)	0.82
Sulphuric acid (H_2SO_4)	0.42
Phosphoric acid (NPO_3)	0.53
Silica (SiO_3)	1.18
Total	9.70

Carbonic acid (H_2CO_3), large amount; not determined.

It is evident that the acids and bases would unite in the form of carbonates, chlorides, sulphates, and phosphates.[1] The waters are very useful in chronic diarrhœa and the debility incident thereupon. They are highly recommended in the debilitated states attending uterine and ovarian diseases and in restoring anæmic and puny children.

ROCKY RIVER SPRINGS,

STANLEY COUNTY.

Post-office, Silver. Hotel. These springs are located near the village of Silver. They are four in number, all within a radius of one hundred yards. Each is said to possess different properties from the others, but no analysis can be obtained in verification of this statement. They have been in use as a resort for one hundred years, and it is said that they were visited by the daughter of Aaron Burr. The climate of the region is genial and salubrious, and the air pure and fresh. The elevation of the location is about 750 feet above tide-water. The resort and its surroundings offer unusual attractions for the seeker after a restful and tranquil sojourn away from home. A comfortable hotel is situated near the springs. It is stated that the good effects of the waters are shown in cases of dyspepsia, early phthisis, debility, and skin affections.

SHAW'S HEALING SPRINGS,

WARREN COUNTY.

Post-office, Littleton. Hotel. Access from Weldon *via* the Raleigh and Gaston R. R. (Southern System) twenty miles west to Littleton; thence one-half mile to springs. The location is seventy-five miles from Raleigh.

These springs were discovered by Mr. J. L. Shaw, the present proprietor, only a few years since. They are located close to the thrifty and healthful little town of Littleton, a place of about 1000 inhabitants. The New Spring Park Hotel, controlled by the Springs company, is located in the centre of the town, at the corner of Main and Spring Streets. The distance to the springs constitutes an easy stroll or a pleasant drive along a well-kept road, amid attractive scenery. The springs are sixteen in number, four of which are believed to possess decided medicinal properties. No analyses have

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[1] According to E. E. Smith, Ph.D., of New York, to whom we have submitted this analysis, the combinations would result as follows, reckoned in grains per U. S. gallon:

Solids.	Grains.	Solids.	Grains.
Sodium chloride	1.31	Iron bicarbonate	3.98
Sodium sulphate	0.68	Iron phosphate	0.82
Sodium bicarbonate	0.93	Alumina	0.31
Potassium bicarbonate	1.02	Silica	1.18
Calcium bicarbonate	4.85		
Magnesium bicarbonate	1.21	Total	16.32
Manganesium bicarbonate	0.03		

been made, but, judging from the speedily favorable influence of the waters in cases of acid dyspepsia and in anæmic states, they are of the alkaline-chalybeate type. The local use of the waters in some of the humid skin affections is often followed by good results.

SHOCCO SPRINGS,

WARREN COUNTY.

Post-office, Henderson. No hotel at present. Access *via* Raleigh and Gaston R. R. (Southern System). The location is fifty-seven miles northeast of Raleigh.

The springs have an elevation of over 1000 feet above the sea-level. They were formerly well known as a resort, but since the destruction of the buildings by fire the place seems to be more or less neglected. An analysis made in 1890 by Dr. H. B. Battle shows a result as follows:

SHOCCO SPRINGS.

Sulphated-saline.

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	0.17
Sodium sulphate	11.06
Magnesium sulphate	1.62
Calcium sulphate	42.95
Calcium carbonate	1.16
Calcium chloride	3.77
Silica	4.21
Organic and volatile matter and loss	3.12
Total	68.06

The waters are not sold as far as we can learn.

SPARKLING CATAWBA SPRINGS,

CATAWBA COUNTY.

Post-office, Sparkling Catawba Springs. Hotel and cottages. Access *via* Western North Carolina R. R. to Hickory, sixty miles west of Saulsbury; thence six miles by carriage to springs.

The location of the Sparkling Catawba Springs is within the shadow of the Blue Ridge Mountains, 1150 feet above the sea-level. This part of the State, known as the "Piedmont Section," has long been famous for its bracing climate, pure air, and uniform temperature. The springs are three in number, and gush from the ground in a shaded valley surrounded by a circular range of timbered hills and within one mile of the banks of the Catawba River. No analysis has been made, but the springs are said to be blue and white sulphur and chalybeate in character. The new hotel and cottages afford comfortable accommodations for about 400 guests. We are informed by Dr. E. O. Elliott, of the springs, that the waters possess well-marked alterative and tonic properties, and generally increase the appetite, assist the digestion, and promote the assimilation of food. A very complete and comfortable bathing establishment is at hand.

YADKIN MINERAL SPRINGS,

STANLEY COUNTY.

Post-office, Palmersville. Boarding-houses. Access *via* Southern R. R. to New London, thence six miles by private conveyance to springs.

This resort is charmingly located in a wild and picturesque region, penetrated by the Yadkin River, and covered by the Oconeechee Range of mountains. Like the usual North Carolina mountain climate, the atmospheric conditions prevailing in this section are eminently conducive to good health and longevity. The rainfall at the springs is about fifty-three inches annually, and is quite uniformly distributed through the seasons. There is no hotel, but during the season, from May to November, accommodations may be obtained at a reasonable rate in a number of private boarding-houses. The springs are two in number, a chalybeate spring yielding 60 gallons of water per hour, and a sulphur spring flowing at the rate of 180 gallons per hour. No quantitative analysis is available. Much beautiful scenery is found in the neighborhood of the springs: the falls of the Yadkin River, the Narrows, and the "Devil's Den," a great cave in the hills, being the most prominent.

Additional North Carolina spring resorts are:

Alum Spring, near Catharine Lake, Onslow County.

Cleveland Mineral Springs, near Shelby, Cleveland County. Sulphureted and chalybeate.

Cowhead Springs, near Washington, Beaufort County.

Criswell's Sulphur Springs, near Mooresville, Iredell County.

Ellendale Chalybeate Springs, Ellendale, Alexander County.

Ellerbe Spring, Ellerbe Springs, Richmond County.

Healing Springs, Healing Springs, Davidson County.

Jackson Springs, Jackson Springs, Moore County.

Misenheimer's Sulphur Springs, Copal Grove, Stanly County.

Piedmont Springs, near Danbury, Stokes County.

Piedmont Springs, Piedmont Springs, Burke County.

Seven Springs, Seven Springs, Wayne County.

Sulphur Springs, Sulphur Springs, Montgomery County.

Warren White Sulphur Springs, ten miles from Ridgeway, Warren County.

The remaining springs of the State are either undeveloped or are of little importance.

NORTH DAKOTA.

This State is about 210 miles in extent from north to south, with an average breadth of 360 miles. It is situated within the parallels of 46° and 49° north latitude, and 96° 20′ 30″ and 104° west longitude. The greater portion of the State is a rolling prairie, in which are many streams and lakes, but no swamps or marshes. In the northeast the surface is slightly elevated. There are no mountains within the State, and the greater portion is well adapted to agricultural and pastoral pursuits. The Missouri is the chief river. It runs diagonally across the western half of the State, and is navigable throughout its entire length. Among its tributaries are the Yellowstone, Owl, Dakota or James, the Heart, and the Little Missouri Rivers. The Red River of the North forms the eastern boundary, separating the State from Minnesota. It has eight large affluents from the west. The State has a number of deep and beautiful lakes. The Minnicracken, or Devil's Lake, in Ramsey County, is a large body of salt water, fifty miles in length and fourteen in breadth, and has no outlet. Other lakes of the State are Sweetwater, Stump, Ellis, Dry, Long, Rosa, Bismarck, Horse, and Twin Lakes. Some of these lakes are beautiful sheets of water and delightful summer resorts. Along the water courses there is a considerable growth of walnut, poplar, oak, elm, maple, ash, willow, and cottonwood. Wild game is fast disappearing; the herds of buffalo that formerly roamed its prairies have been entirely exterminated, and with them to a great extent the elk, deer, antelope, wolf, and bear.

The climate of North Dakota is dry and salubrious. The winters are clear, crisp, and sunny, as a rule, with heavy snowfalls. The summers have hot days and cool nights. Great extremes of temperature are occasionally observed in the State, ranging from 107° F. in the summer to 49° F. below zero in winter. There is an earlier spring than is observed in the same latitude in Eastern States. The average rainfall is about 18 inches.

The mortality rate for North Dakota, according to the latest United States Census returns, is 9.39 per 1000 of inhabitants. The figures for phthisis show only 0.91 per 1000 of population.

As far as we have been able to learn, there are no well-developed mineral springs in the limits of North Dakota. According to the United States Geological Reports the following springs are found:

Acid Spring, at Devil's Lake, Ramsey County.
Artesian Well, also at Devil's Lake. Sulphureted and chalybeate.
Dunseith Mineral Spring, Dunseith, Rolette County.
Salt Springs, near Grafton, Walsh County.
Salt Springs, near Pembina, Pembina County.
Sulphur Springs, Devil's Lake, Ramsey County.
Wamduska Lake, Wamduska, Nelson County. Saline.

Correspondence with these localities produces very little further information. It is probable that as the State becomes more thickly inhabited some of the above springs, as well as others at this time unknown, will be developed.

OHIO.

The State of Ohio comprises an area of 39,964 square miles, and extends from 38° 25′ to 42° north latitude, and from 80° 28′ to 84° 42′ west longitude. The State has no mountains, the surface consisting of an undulating plain, ranging in elevation from 1550 feet to 430 feet above the sea-level, the portions above 1400 feet or below 500 feet being comparatively insignificant. The chief feature in the topography of Ohio is the great divide forming the watershed, which extends diagonally across the State from the northeast to southwest, and divides the surface into two unequal slopes. The northern, which is much the smaller, sends its waters into Lake Erie, 565 feet above the sea-level, while the southerly slope declines to the Ohio River 430 feet above tide-water. The State is well watered. The Ohio, the principal river, has a course of 436 miles along the southern boundary, flowing through a charming valley, with wooded hills rising from it to a height of 500 or 600 feet. The Muskingum, Sciota, Hocking, Mahoning, and Great and Little Miami Rivers flow into the Ohio. On the north are smaller streams flowing into Lake Erie: the Cuyahoga, Vermilion, Huron, Portage, Sandusky, and others.

There are but few especially striking natural features in the State, though many of the valleys present scenery of tranquil loveliness. Ohio is rich, however, in the heritage of an ancient civilization. Numerous memorials of antiquity, in the shape of mounds or tumuli, fortifications and embankments, dot the central and western sections of the State, and are in many places still perfect in outline. Extensive forests of hard woods abound in the State, and vineyards and orchards thrive remarkably.

The climate of Ohio, though quite variable, is, on the whole, favorable to a symmetrical development and high degree of vigor of human life. In the south the mean annual temperature is 54° F.; in the northern part of the State, 49° F. The annual range is not less than 100°, and sometimes 130°, the extreme summer heat reaching 100° in the shade, while cold waves in winter may depress the mercury to 30° below zero. Sudden changes of temperature are not uncommon. The vast body of water in Lake Erie favorably modifies the climate in the northern margin of the State.

The mortality-rate in Ohio, as computed from the latest United States Census returns, is 13.57 per 1000 of population, phthisical mortality, 1.74 per 1000 of population.

According to the State and National Geological Reports, mineral springs are exceedingly numerous in Ohio. A vast majority of the waters are calcic, and many of them also chalybeate and sulphureted. Few of the springs are developed as resorts, however, and a still smaller number are used for commercial purposes. Several of the old Ohio spring resorts have lapsed into neglect and disuse. The rocky floor of the State is entirely composed of unaltered stratified rocks of the Paleozoic age. Not a single trap, dyke, or volcanic rent intersects them, and not a trace of igneous metamorphism is shown in any portion of their extent. These strata are disposed in plains almost absolutely horizontal. Not only are sharp flexures wanting, but faults deserving the name are found in but a single corner of a single county. It is, therefore, not surprising that the springs of the State are all cold, nothing resembling a thermal water being reported from any locality.

We have succeeded in obtaining direct recent information of four localities now in use as resorts. Accounts of several other springs compiled from geological reports and from the older works are marked thus *.

ADAMS COUNTY MINERAL SPRINGS,

Adams County.

Post-office, Mineral Springs. Hotel and cottages. Access: From Cincinnati take the Cincinnati, Portsmouth and Virginia R. R. to Mineral Springs Station, thence transfer by private conveyance to the springs, four miles distant.

These springs flow from the base of a high hill, and are surrounded by beautiful and picturesque scenery. They are two in number, and yield about 60 gallons of water hourly. A partial analysis of the waters by Prof. E. S. Wayne, analytical chemist, of Cincinnati, shows them to be highly charged with gas, and to contain 205.35 grains of solid matter to the United States gallon, composed as follows:

Magnesium chloride.
Calcium chloride.
Calcium sulphate.
Calcium carbonate.
Sodium chloride.
Iron oxide.
Iodine.

These springs have long been resorted to by persons suffering from affections involving the stomach, bowels, and liver. The water is evidently of the saline-calcic-chalybeate variety. The accommodations for visitors are now very satisfactory, the hotel having recently been enlarged to more than double its former capacity. There are also a number of cottages suitable for families wishing to keep house during the season. As a resort these springs afford a sequestered retreat for those who seek respite from the cares of business or need the refreshing influences of rural scenery and air.

*CEDAR SPRINGS,

PREBLE COUNTY.

Post-office, New Paris. Hotel. Access: Take Pittsburg, Cincinnati and St. Louis R. R. to New Paris, thirty-five miles west from Dayton, thence take carriage one mile to springs.

These springs are situated in a rolling section of country, about 1000 feet above the sea-level. The surroundings are very pleasant and attractive. There are said to be not less than one hundred springs within an area of two square miles. Several are used for medicinal purposes. We present an analysis of one of them by Dr. A. Fennel:

WASHINGTON SPRING (CEDAR SPRINGS).

Light Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	2.26
Magnesium carbonate	5.82
Iron carbonate	1.32
Calcium carbonate	3.96
Calcium sulphate	1.24
Sodium sulphate	0.18
Calcium phosphate	2.13
Sodium chloride	0.98
Alumina	0.22
Total	18.11

The waters resemble those of the Bethesda Spring at Waukesha, Wisconsin, but contain more iron. It is claimed that they are especially valuable in catarrh of the bladder, renal diseases, and dyspepsia.

*CINCINNATI ARTESIAN WELL,

HAMILTON COUNTY.

This well is located at the Cincinnati Gas-works, and is 1245 feet in depth. There is a continuous flow of water. The following analysis is by E. S. Wayne:

CINCINNATI ARTESIAN WELL.

Muriated-saline. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	8.14
Calcium carbonate	17.33
Potassium sulphate	27.27
Sodium chloride	519.60
Magnesium chloride	18.14

One U. S. gallon contains:

Solids.	Grains.
Calcium chloride	22.26
Potassium chloride	3.27
Magnesium bromide	0.26
Magnesium iodide	0.19
Iron oxide	0.37
Silica	0.49
Total	617.32

Gases.	Cubic inches.
Sulphureted hydrogen	7.76
Carbonic acid	10.32

This is a very rich saline sulphureted water, and ought to be of value in the treatment of diseases for which such waters are used.

CRUM MINERAL SPRINGS,

MAHONING COUNTY.

Post-office, Girard. Access: Street railroad passes within one and a quarter miles of springs.

These springs are located within four miles of Youngstown, Mahoning County, and one and a half miles from Mineral Ridge, Trumbull County. No hotel has yet been built, but the water has been used commercially for the past seven years. The surroundings are said to be very attractive and well adapted for a summer resort.

The springs are four in number; only one, however, is in use. The following analysis was made by S. W. McKeown, analytical chemist:

CRUM MINERAL SPRING.

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	5.31
Magnesium carbonate	1.80
Iron carbonate	0.59
Sodium carbonate	0.14
Magnesium sulphate	1.17
Sodium chloride	0.48
Silica	0.29
Total	9.78

This analysis shows a combination of very useful ingredients. They give the water the properties of a ferruginous tonic, a mild diuretic, an antacid, and in large doses, a light laxative. The water is useful in disordered states of the stomach and in functional affections of the liver and bowels. Its continuous use tends to overcome chronic constipation.

*ERKENBRECKER'S SALT WELL,

HAMILTON COUNTY.

Post-office, Ludlow Grove. Access: Ludlow Grove is a station on the Cincinnati, Hamilton and Dayton R. R., six miles east of Cincinnati.

This salt water was unexpectedly discovered some years since in the course of boring for an artesian well. It was analyzed by E. S. Wayne, analytical chemist, with the following results.

ERKENBRECKER'S SALT WELL.

Muriated-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	14.06
Calcium carbonate	6.33
Calcium sulphate	6.07
Sodium chloride	4300.10
Calcium chloride	786.61
Magnesium chloride	542.04
Iron chloride	53.46
Sodium bromide	28.21
Silica	1.22
Total	5738.10

This is a very strong brine, and possesses many valuable mineral ingredients. It is not adapted for internal use without considerable dilution. The water is used somewhat for bathing purposes by persons in the neighborhood.

FOUNTAIN PARK MAGNETIC SPRINGS,

CHAMPAIGN COUNTY.

Post-office, Fountain Park. Hotel and cottages. Access *via* Pennsylvania R. R. (P., C., C. & St. L., Indianapolis Division). The hotel is within five minutes' drive of the Fountain Park Station. The location is thirty-four miles west of Columbus and twelve miles east of Urbana.

Fountain Park village was laid out in 1882, soon after the discovery of the springs. The resort came under control of the present management in 1894. The site of the village is one of great natural attractiveness. The elevation is 1200 feet above the sea-level and the surrounding country gently undulating. The hotel and cottages are located in a beautiful tract of forty-three acres, in which are numerous hills surmounted by groves of deciduous trees. New acme stone walks and drive-ways have recently been laid around the hotel grounds, and an artificial lake of sufficient size for boating constructed. The large lawn is adapted for all kinds of out-door sports and games. Brush Lake, one mile east of the Park, affords rare attractions to the piscatorially inclined visitor.

The waters at Fountain Park proceed from five flowing wells. The largest is 2200 feet in depth and fills a ten-inch pipe at about twenty-one pounds' pressure. Following is an analysis of this spring, made in 1892 by Prof. E. S. Wayne, of Cincinnati :

FOUNTAIN PARK SPRINGS.

Muriated-saline Alkaline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	13.64
Calcium chloride	4.22
Magnesium chloride	2.12
Potassium sulphate	2.61
Calcium carbonate	26.24
Magnesium carbonate	11.41
Iron carbonate	0.16
Silica	0.24
Organic matter	0.39
Total	61.03

This is an excellent water of the alkaline-saline-calcic variety. The presence of a small quantity of carbonate of iron will prevent debilitating effects on continuous use. The water has been found valuable in acute and chronic rheumatism, gout, dyspepsia, and diabetes.

Two of the remaining four wells were analyzed in 1895 by Prof. H. A. Weber, of the Ohio State University. They show the same general characteristics as Spring No. 1 (above). There is an excellent modern hotel in the Park. It contains twenty well-equipped bath-rooms, under the charge of an experienced physician.

STRYKER MINERAL SPRINGS,

WILLIAMS COUNTY.

Post-office, Stryker. Visitors received in private families. Access: The village of Stryker is located on the Air Line Division of the Lake Shore and Michigan Southern R. R.

The springs are pleasantly located in the village. They have been allowed to languish somewhat, but we are informed that they have recently passed into the hands of Dr. C. F. Mignin, who proposes to repair and refit the bath-houses, with the intention of establishing a first-class sanitarium. The following analysis of the water was made in 1870 by S. H. Douglass, analytical chemist :

STRYKER MINERAL SPRINGS.

Sulphated and muriated. Calcic-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium bicarbonate	68.30
Iron bicarbonate	9.93
Potassium sulphate	185.34
Sodium chloride	231.86
Magnesium chloride	118.96
Silica	2.63
Hydro-sulphuric acid	4.49
Total	621.51

This water is exceedingly rich in valuable chemical compounds. It possesses an exceptionally large quantity of potassium sulphate, which, with chloride of magnesium, gives it efficient laxative and cathartic properties. The water is also a rich chalybeate, and should be valuable in anæmic and debilitated states, especially when attended by sluggishness of the liver and constipation.

*SULPHO-SALINE SPRING,

HAMILTON COUNTY.

Post-office, Cincinnati. Access: By Elm Street cars to Henry Street, thence one block west.

This well is 2408 feet in depth and flows in an abundant and continuous stream at a temperature of 62° F. An analysis by Prof. Wayne, of Cincinnati, shows the following ingredients:

CINCINNATI SULPHO-SALINE SPRING.

Muriated-saline-alkaline.

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	9.13
Calcium carbonate	19.34
Calcium sulphate	29.20
Potassium sulphate	2.30
Sodium phosphate	1.34
Sodium chloride	534.77
Magnesium chloride	17.27
Calcium chloride	22.19
Potassium chloride	3.95
Magnesium bromide	0.39
Magnesium iodide	0.30
Iron oxide	0.43
Silica	0.79
Loss	0.76
Total	642.16

This analysis shows a considerable presence of valuable ingredients. The water is well adapted for the treatment of portal congestion, hemorrhoids, metallic poisoning, etc. In the form of baths it is useful in many of the chronic skin affections and in advanced syphilis. A very elegant and elaborate bath-house has been fitted up and supplied with all the modern appurtenances of such an establishment.

*YELLOW SPRINGS,

GREENE COUNTY.

Hotel. Access: Yellow Springs is a station on the Little Miami R. R., seventy-four miles northeast of Cincinnati (Walton).

The springs are pleasantly situated on the banks of the Little Miami River. The surrounding country is undulating, and attractive drives lead in all directions. The springs yield about 660 gallons of water per hour. An analysis by Messrs. Wayne and Locke resulted as follows:

YELLOW SPRINGS.

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	19.57
Calcium sulphate	1.35
Sodium chloride	0.15
Magnesium chloride	0.17
Calcium chloride	1.54
Iron oxide	0.39
Total	23.17

The water possesses mild diuretic and tonic properties. The springs have been allowed to decline of late years, and we are informed that they are not now in use as a resort.

Among other springs of Ohio which have been more or less resorted to may be mentioned the following:

Bellbrook Magnetic Spring, Bellbrook, Greene County.

Blue Rock Spring, East Cleveland, Cuyahoga County.

Electro-Magnetic Springs, near Woodstock, Champaign County.

Green Mineral Spring, Green Spring, Seneca County; flows 375,000 gallons per hour.

Howland Springs, east of Warren, Turnbull County; sulphureted.

Len-a-pe Magnetic Springs, Delaware, Delaware County; two in number; flow 700 gallons hourly; alkaline-calcic.

Ohio Magnetic Spring, Magnetic Springs, Union County; alkaline-calcic.

Tawawa Springs, Wilberforce, Greene County; chalybeate.

Wyandot Magnetic Well, near Upper Sandusky, Wyandot County; sulphureted.

The following are used commercially:

Crystal Rock Spring, Erie County.

Devonian Mineral Spring, Lorain, Lorain County.
Magnetic and Saline Spring, Marysville, Union County.
Midland Mineral Springs, Midland, Midland County.
Mustcash Spring, Erie County.
Puritas Mineral Springs, Rockport, Cuyahoga County.
Partlebaugh Mineral Springs, Urbana, Champaign County.
Rex Mineral Spring, New Richmond, Clermont County.
Sulphur Lick Springs, Anderson, Ross County.
Wewaka Spring, near Richard's Station, Lucas County.

OKLAHOMA.

There are numerous springs in this Territory, many of which are no doubt mineralized. As far as we have been able to learn, however, none of them has yet been developed as a resort. Although rapidly filling with white settlers, the greater part of the Territory is still occupied by wild Indian tribes. Doubtless as civilization advances within its limits we shall hear more of its mineral springs, as well as of its other resources, which are evidently varied and numerous. The greater portion of the Territory is a gently rolling prairie, having a general slope from northwest to southeast, and this inclination of the surface determines the current of the chief streams. The climate of Oklahoma is equable and generally salubrious. The summers are long and warm, while the winters are short and cold. The mean annual temperature is 58° F., and the mean rainfall 31.2 inches.

The mortality-rate for the Territory, according to the United States Census of 1890, was 5.69 per 1000 of population; the death-rate from consumption, 0.34 per 1000 of population. These figures were no doubt greatly influenced by the character of the population occupying the Territory at that time.

OREGON.

The State of Oregon extends from 42° to 46° 18′ north latitude, and from 116° 40′ to 124° 25′ west longitude. The State is divided by the Coast, Cascade, and Blue Mountains into well-marked sections. The Cascade Mountains, varying in height from 4000 to 11,000 feet and running from north to south, separate the State into two unequal parts, known as Eastern and Western Oregon. The highest peaks of this range are Mount Hood and Mount McLaughlin, each 11,000 feet high. The Coast range runs parallel with the Cascades, and between them and the ocean the general altitude varies from 1000 to 4000 feet. Each of the great ranges throw out spurs, and the eastern division is further broken by the Blue Mountains, which run northeast and southwest and have an average altitude of 5000 to 7000 feet. The rivers of Oregon are very numerous, the most important being the Columbia, Snake, Willamette, Rogue, and Umpqua. The valleys are deep and irregular, and in many places the rivers cut their way through canyons of great depth. There are also many lakes, most of them being in the southern central portion of the State. In Lake County are Upper Klamath Lake, Summer Lake, Albert Lake, and part of Goose Lake, and in the adjoining counties Silver, Harvey, Fish, Malheur, Diamond, Crater, Wapota, and other lakes. The State has a coast line of 300 miles, with several large and accessible harbors. Oregon takes a front rank in varied and picturesque scenery. In the mountain and lake regions and along the banks of the great rivers Dame Nature has wrought her fancies in many diverse moods, and the traveller cannot fail to be charmed and instructed by the romantic grandeur and beauty of the landscapes.

The mild climate of Western Oregon and the heavy and incessant rains with which it is visited are due to the warm oceanic current from Japan, flowing south along the coast. The southwest warm winds from the Pacific also aid in distributing vapors over Western Oregon, and over the eastern section also to a lesser extent. This often takes the form of heavy fogs, dews, and occasional snows. In the Willamette valley the average yearly rainfall is 44 to 54 inches, which is about the same as at Philadelphia and at Davenport, Iowa. In the Umpqua and Rogue River valleys it is somewhat less, while near the coast it rises to 60 inches. Thunder storms seldom occur in the State, and tornadoes and cyclones are unknown. The mean annual temperature ranges from 44° F. near the Cascade Mountains to 50° F. in the vicinity of the ocean. The mortality-rate for Oregon, as computed from the census returns for 1890, was 8.21 per 1000 of population. The phthisical death-rate was 0.97 per 1000 of population.

The mineral springs of Oregon are numerous, and some of them of great value, although but few analyses have been made. The so-called soda springs predominate. There are also a number of thermal springs. From various sources, but chiefly from direct correspondence and inquiry, we have gained information relating to ten localities. Those whose present status is undetermined are marked thus.* There are several valuable springs in the State which are not accessible as yet to the mails. It has not been possible to locate the "Beer" Springs, mentioned by Walton, and they have not been admitted to the list.

BELKNAP HOT MEDICAL SPRINGS,

LANE COUNTY.

Post-office, Belknap Springs. Hotel and camping grounds. Access *via* Southern Pacific Railroad to Eugene, one hundred and twenty five miles south of Portland; thence sixty miles east by stage to springs.

The location of these springs is in the heart of the Cascade Mountains, 2000 feet above the sea-level. This is a very fine and picturesque region, and presents many attractions to the tourist and invalid. The climate is equable, the weather during the summer months being generally clear and pleasant, with cooling winds.

The average summer temperature is 65° F., while it is stated that the average winter range is but 20° lower. The McKenzie River, nearby, is famous for its magnificent trout; and deer and other game abound in this region. There is only one spring, but it yields about 12,500 gallons per hour. The temperature of the water is 188° F. The following analysis was made in 1894 by Prof. G. W. Shaw, of the Oregon State Agricultural College, at Corvallis:

BELKNAP HOT SPRING.

Muriated-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	13.91
Calcium chloride	62.20
Potassium chloride	7.68
Magnesium chloride	2.90
Sodium chloride	53.93
Manganese chloride	Trace.
Silica	4.72
Iron and alumina	0.17
Total	145.51

The bathing facilities comprise medicated, steam, electric, and shower baths, hot or cold, with massage. A large swimming tank is an attractive feature. The baths are attracting considerable attention in the treatment of rheumatism, syphilis, and skin diseases.

BOSWELL SPRINGS,

DOUGLAS COUNTY.

Post-office, Boswell. Hotel. Access: Boswell is a flag station on the Southern Pacific R. R. (Shasta route), one hundred and sixty-three miles south of Portland. The location of the hotel is one hundred feet from the railroad.

The situation is on Elk Creek, about forty-five miles from the coast and three hundred and fifty feet above tide-water. The surrounding country is made up of hills and valleys. There are two springs at the resort. A partial analysis of the stronger springs, made at the University of California, showed the presence of 2000 grains of solid matter to the United States gallon, made up chiefly of the following ingredients:

Iron.
Bromine.
Potassium.
Calcium.
Magnesium.
Sodium.

The weaker spring was analyzed by Philip Harvey, of Portland, Oregon, who gave its contents as follows:

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	173.00
Magnesium chloride	145.00
Calcium chloride	115.00
Iron carbonate, Calcium carbonate,	Small quantities.
Total	433.00

Both springs are heavily charged with carbonic acid and sulphureted hydrogen gas. The waters are evidently of the muriated-saline-chalybeate variety. They have been found useful in constipation, chronic malarial infection, dyspepsia, functional liver complaints, and other disorders.

COLESTIN SODA SPRINGS,

JACKSON COUNTY.

Post-office, Colestin. Hotel. Access *via* Southern Pacific R. R., which passes within one hundred yards of the hotel. Daily passenger trains in both directions.

These springs are located on the Siskiyou Mountains, 3500 feet above the sea-level. They are two in number, and yield about 120 gallons of water per hour, having an unvarying temperature, summer and winter, of 55° F. It has not been analyzed, but is said to contain salts of sodium, iron, and sulphur. The water has been used with apparent benefit in catarrhal states of the broncho-pulmonary mucous membrane, in bronchial asthma, and in certain renal affections.

DES CHUTES HOT SPRINGS,

CROOK COUNTY.

These springs are located eight miles north of Warm Springs. They issue from the base of the cliffs along the valley of the Wam-Chuck River. Their number is quite large, and some of them have a copious flow. The temperature of two of them was respectively 143° and 145° F. The following analysis was made by L. M. Dornbach and E. N. Horsford:

DES CHUTES HOT SPRINGS.

Alkaline-saline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	34.50
Sodium sulphate	9.46
Calcium sulphate	1.82
Sodium chloride	20.42
Potassium chloride	2.00
Magnesium chloride	1.21
Sodium silicate	8.20
Iron	Trace.
Total	77.61

Carbonic acid gas, 22.56 cubic inches.

This analysis shows an exceedingly valuable combination of mineral ingredients. So far as we are able to learn, however, the springs have not been improved as a resort.

LAKE VIEW HOT SPRINGS,

LAKE COUNTY.

Post-office, Lake View. Hotels in the town. Access *via* Southern Pacific R. R. to Ager, Cal., and thence by stage.

The springs are located one and one-half miles south of Lakeview and four miles northeast of Goose Lake, one of the largest bodies of fresh water in the West (fifty miles in length, with an average breadth of fifteen miles). The elevation is about 5000 feet above the sea-level, and the surrounding country of a mountainous character. The climatic conditions are very favorable. We are informed that the water has a temperature of 164° F., and flows at the rate of about 500 gallons per hour. A partial analysis by Dr. Parnell, post surgeon at Camp Warner, Oregon, in 1869, showed the presence of iron, soda, sulphur, magnesia and other mineral ingredients. The water is said to be beneficial in numerous complaints, especially rheumatism. The attractions at this place afford excellent inducements for the establishment of a first-class health resort.

LOWER SODA SPRING,

LINN COUNTY.

Post-office, Lower Soda. This spring is located in a mountainous region on the south fork of the Santiam River, at a level of 1300 feet above the Pacific Ocean. It discharges 20 or 30 gallons of water per hour, but no analysis has been made. We are informed by Mr. John Atkinson, the proprietor, that the people of the surrounding country are in the habit of visiting the springs and camping out. The water has a considerable local reputation in stomach and kidney disorders.

M'CALLISTER'S SODA SPRINGS,

JACKSON COUNTY.

Post-office, Lake Creek. Camping grounds. Access *via* Southern Pacific R. R. to Central Point; thence by private conveyance over fair wagon road twenty-five miles east to springs.

McCallister's Springs are located in a picturesque mountain region, 5400 feet above the level of the sea. This region is noted for its pure, dry atmosphere and its freedom from miasmatic diseases. The springs are two in number, and flow about 120 gallons per hour each. The water has not yet been analyzed. We are informed by Mr. J. G. McCallister, the proprietor, that the waters have a wide reputation among the residents of the surrounding country in the treatment of chronic malarial poisoning. It is said that malaria is unknown in the neighborhood, and almost every person suffering from fever and ague is relieved after a few days' stay at the springs. We may easily believe, however, that these good results are at least partially due to the bracing mountain air of the neighborhood. The place is also much resorted to by dyspeptic and rheumatic patients. The water is always cold, and is said to possess excellent properties as a tonic and appetizant.

*WARM SPRINGS,

CROOK COUNTY.

Post-office, Warm Springs. These springs are located on an Indian reservation of the same name, and are used by the Indians for bathing purposes. The water is said to be very hot and to contain a large percentage of borate of soda.

*WILHOIT'S SODA SPRINGS,

CLACKAMAS COUNTY.

Post-office, Wilhoit. Hotel. Access: From Salem, Marion County, twenty-five miles northeast by wagon road. These springs are seven in number, and flow about 700 gallons per hour. An analysis by J. A. Veatch, M.D., in 1869, showed the following mineral ingredients:

WILHOIT'S SODA SPRINGS.

Alkaline-saline-chalybeate.

One U. S gallon contains: Solids.	Grains.
Sodium carbonate	87.57
Magnesium carbonate	85.32
Calcium carbonate	32.23
Iron carbonate	6.00
Sodium sulphate	3.40
Magnesium sulphate	6.45
Sodium chloride	201.00
Iodine	Trace.
Total	421.97

Carbonic acid gas, 22.56 cubic inches.

The water is said to have a temperature as it flows of 35° F.

This is an exceedingly valuable water, combining as it does a number of important chemical ingredients. It is very pleasant to the palate, and, according to Dr. H. Carpenter, it operates on the second day as a laxative and diuretic. It contains a considerable percentage of iron, which gives it tonic and reconstructive properties.

WOLFER'S MINERAL SPRING,

MARION COUNTY.

Post-office, Hubbard. Hotels. Access *via* Southern Pacific R. R. to Hubbard, thirty-one miles from Portland and twenty miles from Salem. The spring is within five minutes' walk of the depot.

This spring is mentioned as "Lehman's Spring" in the Geological Reports for 1895. Hubbard is situated in the Willamette valley, in the midst of a fine fruit and garden country. The spring (artesian) is located on the hillside, at a level of 212 feet above the sea. It is surrounded by an arbor of wild willows, and forces its way to a height of four feet above the surface, forming a beautiful fountain. It yields about 6000 gallons of water per hour. There are beautiful grounds about the springs, well adapted for outdoor sports, picnics, etc. According to a partial analysis by Prof. Fisk, the water contains

Calcium carbonate.
Magnesium carbonate.
Sodium chloride.
Potassium chloride.
Iron oxide and alumina.
Silica.

The water is said to possess valuable properties as a tonic and laxative. The resort is said to be an exceptionally fine location for the establishment of a sanitarium.

The following-named springs are also used as resorts:

Aurora Saline Springs, Aurora Mills, Marion County; two in number, flow 600 gallons hourly; saline-calcic.

Cole's Soda Springs, near White Point, Jackson County.

Foley Springs, near McKenzie Bridge, Lane County; thermal.

Linkville Springs, near Linkville, Klamath County; thermal.

Mineral Springs, on Blue Mountains, near John Day, Grant County; thermal.

Payton or Snowden Spring, near Drain's Station, Douglas County.

Solfataire, near Linkville, Klamath County; used for vapor baths.

White Sulphur Springs, head of Clackamas River, Clackamas County.

The Siskiyou Spring, at Soda Springs, Jackson County, is used commercially.

PENNSYLVANIA.

Pennsylvania extends from 39° 43′ to 42° 15′ north latitude, and from 74° 40′ to 80° 41′ west longitude. Topographically the State is divided into three parts, viz., a southeast district, the open country between the South Mountains and the sea, which is at no point more than 600 or 700 feet above the ocean level; a middle belt of parallel valleys, separated by low, corresponding mountain ridges; and a northern and western upland, behind the escarpment of the Alleghany Mountains, elevated from 1000 to 2500 feet above tidewater. The surface of the State is greatly diversified, being level in the southeast, mountainous in the centre, and undulating in the west. The mountain ridges cross the State from northeast to southwest. They cover fully one-fifth of the total area, and are all members of the great Appalachian chain. The entire breadth of this mountain system is about two hundred miles. It forms numerous beautiful and fertile valleys, and incloses the richest bituminous coal fields in the United States. Much grand and picturesque scenery is found in this part of the State. The principal rivers of Pennsylvania are the Susquehanna, Delaware, Allegheny, Monongahela, Lehigh, and Schuylkill. The climate of so great a State is necessarily varied, and is made more variable by its situation on the eastern side of the continent, facing the Gulf Stream. In the northern and western portions the winters are cold, severe, and protracted. The southern middle counties enjoy genial weather the whole year round, interrupted by only short intervals of intense heat or cold. In the east the weather conditions are very changeable, both in summer and winter. The northwest wind is dry and cold in winter, the southwest wind always mild and rainy, and the southeast ocean wind wet and sultry in summer; but the severe northeasters of New England lose much of their rigor by the time they reach the Delaware. The mean annual temperature ranges from 44° in the northern counties to 52° in the southeast, while the average rainfall varies from 38 inches in the western counties to 42 inches at Philadelphia, and even more in the southeast triangle.

The mortality-rate in Pennsylvania, as computed from the United Census of 1890, was 13.98 per 1000 of population; the death-rate from consumption was 1.46 per 1000 of population.

The mineral springs of Pennsylvania are numerous, and some of them of great value. Like those of the neighboring States, most of them contain iron. A few of the Pennsylvania springs—*e. g.*, the Bath Chalybeate Springs and the Perry County Warm Spring—have lapsed into disuse. Several others, however, have but recently come into prominence, two or three of which possess considerable importance as commercial springs. There are also several excellent springs in the State which have not been developed. We have been able to gain direct information from eighteen spring localities. Not more than half of these have ever hitherto been described in any work on the subject. From the United States Geological Reports and from the older books on springs we have secured knowledge of several additional springs, the present status of which we have not been able to determine. They are denoted thus*.

BEDFORD SPRINGS,

BEDFORD COUNTY.

Post-office, Bedford. Hotel. Access: The Baltimore and Ohio R. R. transfers passengers at Cumberland, Md., and the Pennsylvania R. R. at Huntingdon, Pa.

The Huntingdon and Broad Top R. R. connects with Pennsylvania R. R. trains from the East and West, and runs an express train of parlor cars through to Bedford without stop.

The Bedford Mineral Springs have their source in a beautiful valley on the eastern slope of the Alleghany Mountains, at an elevation of 1080 feet above tide-water. The location is one mile and a half south of the old historic town of Bedford, the county-seat of Bedford County, in a region noted for its pure, invigorating air, salubrious climate, and beautiful and varied scenery. The medicinal virtues of the springs were known as early as the year 1804.[1] Since those early days the resort has maintained a steady popularity with the tourist, pleasure-seeker, and invalid, and it may to-day be ranked among the best of the many excellent summer watering places which the country affords. In addition to the numerous attractions of climate, scenery, etc., the visitor will find an exceedingly comfortable modern hotel, well equipped with the most recent improvements. A good orchestra is maintained during the season. The Magnesia Spring has been mainly instrumental in giving the place its reputation. It issues from an opening in the rock, about three feet in length and eighteen inches in width, and flows about 2000 gallons of water per hour, without interruption or remission, the year round. A recent examination of the hitherto somewhat neglected Bowling Alley Spring shows it to be quite as strong in magnesium salts, while carrying less lime. We present analyses of these two springs, made in 1895 by Victor G. Bloede, analytical chemist, of Baltimore:

MAGNESIA SPRING (BEDFORD SPRINGS).

Sulphated-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	2.04
Sodium chloride	0.72
Magnesium sulphate	32.54
Magnesium carbonate	6.06

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[1] Gordon's Gazette of the State of Pennsylvania.

One U. S. gallon contains:

Solids.	Grains.
Potassium carbonate	0.38
Calcium sulphate	107.80
Lithium chloride	0.22
Silica	0.35
Iron oxide	0.05
Alumina	0.11
Ammonia	0.02
Nitrates and nitrites	None.
Total	150.29
Free carbonic acid	1.85
Water of crystallization and volatile matter	36.41
Total	188.55

BOWLING-ALLEY SPRING (BEDFORD SPRINGS).

Sulphated-saline. Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	9.70
Sodium chloride	1.12
Magnesium sulphate	32.96
Magnesium carbonate	5.23
Calcium sulphate	83.20
Silica	1.10
Iron oxide	0.04
Alumina	0.09
Nitrates and nitrites	None.
Ammonia	Trace.
Total	133.44
Free carbonic acid	2.17
Water of crystallization and volatile matter	37.74
Total	173.35

These analyses show very potent waters. They are laxative in small doses, purgative in larger. Furthermore, they have a considerable diuretic influence, and each contains sufficient iron to counteract the debilitating tendencies often met with in waters of this character. The Magnesia Spring contains also a small amount of the chloride of lithium, which serves to widen the sphere of its probable utility. The Bowling Alley Spring is quite freely charged with that ever-valuable ingredient of saline waters—the carbonate of sodium—which renders it very useful as an antacid and antifermentative, in addition to its cathartic properties. These waters may be counted upon to render good service in flatulent dyspepsia, functional disturbances of the liver, abdominal engorgement, and chronic constipation. They are also highly recommended by many well-known physicians for gouty and rheumatic disorders. They are used commercially. There are several other valuable springs in the neighborhood.

BEDFORD CHALYBEATE SPRING,

This spring is located about three-qarters of a mile southwest of those above described, and is under a separate management. It is also well known and considerably used. It rises near the centre of a beautiful park of about fourteen acres in extent, which also encloses two other springs, known as the "Sweet" and the "Limestone" Springs. In connection with these springs is the Hotel Chalybeate—a comfortable, home-like house, having a capacity for one hundred and fifty guests. The chalybeate water was analyzed by Prof. F. A. Genth, with the following result:

BEDFORD CHALYBEATE SPRING.

Calcic-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	8.85
Magnesium carbonate	1.20
Iron carbonate	0.44
Manganesium carbonate	Trace.
Sodium carbonate	0.39
Potassium carbonate	0.13
Calcium sulphate	2.74
Calcium phosphate	0.03
Sodium chloride	0.12
Hydrogen sulphide[1]	Trace.
Silicic acid	0.79
Carbonic acid[1] (free)	5.60
Total	20.29

The physiological action of this water tends to increase the appetite, promote the digestion of food, and to improve the quality of the blood. The predominance of the calcareous salts would seem to give the water an astringent and constipating influence. These effects, however, have not been observed by those who have used it freely. It has, in fact, seemed to exert a mild laxative action, and is furthermore quite an efficient diuretic. Its action resembles that of the well-known Bocklet Springs, near Kissingen, in Bavaria. The water is useful in cases of anæmia, general debility, and amenorrhœa, and in convalescence from acute diseases. This water is also used commercially, as well as the evaporated, from which an extract and an ointment are prepared.

BLACK BARREN MINERAL SPRING,

Lancaster County.

Post-office, Pleasant Grove. Hotel. Access *via* Pennsylvania R. R. to Columbia, on the Susquehanna River; thence *via* Columbia and Port Deposit R. R. to Haines' Station; thence by private conveyance two and one-half miles to springs.

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[1] The gases in these analyses would be more correctly rendered in cubic inches.—Ed.

The location is in the southern portion of Lancaster County, one mile from the Susquehanna River and about three miles from where it crosses the Maryland line. The springs have an elevation of about 600 feet above the sea-level, and are surrounded by a picturesque, undulating farming country, containing varied and pleasing landscapes. About a mile to the south is an extensive serpentine ridge, known as the "Black Barren," from which the spring receives its name and doubtless its source. An analysis of the water by Messrs. B. H. Rand and Charles Cresson, of Philadelphia, resulted as follows:

BLACK BARREN SPRING.

Mild Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium sulphate	1.20
Magnesium sulphate	3.24
Silica and suspended matter	1.30
Total	5.74

A re-examination is desirable, as this analysis is evidently incomplete. The water is bottled and sold, and the spring is also used as a resort from May to October. The water is recommended in renal and hepatic disorders, dyspepsia, and rheumatism.

*CARLISLE SPRINGS,

CUMBERLAND COUNTY.

Post-office, Carlisle Springs. Hotel. Access: From Philadelphia *via* Pennsylvania R. R. to Harrisburg, one hundred and six miles west; thence *via* Cumberland Valley R. R. eighteen miles southwest to Carlisle; thence four miles by stage.

These springs issue from the base of the Blue Mountains. They are two in number, and, according to the U. S. Geological Reports are mildly sulphureted in character. No analysis seems to have been made. The location is very picturesque, and the springs have been considerably resorted to by families from the Eastern cities. Not far distant is Canodoquinnet Creek, furnishing fine opportunities for fishing.

CLOVERDALE LITHIA SPRING,

CUMBERLAND COUNTY.

Post-office, Newville. This artesian mineral water fountain is located two and one-half miles northwest of Newville and five miles south of the Doubling Gap White Sulphur Springs. It was discovered in 1865 by a party prospecting for oil. The opening bored through the solid rock to a great depth struck this water vein, which, being released from its subterranean confinement, gushed to the surface at the rate of 300 gallons per hour under the pressure of its own carbonic acid gas. The flow since that time has never diminished, being uniform at all seasons of the year. The water is perfectly clear and entirely free of organic matter, and has a temperature at the spring of 52° F. The following analysis was made in 1889 by Prof. E. T. Fristoe, of the Columbian University, Washington, D. C.:

CLOVERDALE LITHIA WATER.

Alkaline-saline. Chalybeate.

One U. S. gallon contains:[1]

Solids.	Grains.
Potassium carbonate	0.20
Lithium carbonate	0.17
Magnesium sulphate	1.60
Magnesium chloride	0.09
Sodium chloride	Trace.
Magnesium bicarbonate	0.42
Calcium bicarbonate	6.67
Iron oxide and alumina	0.75
Silica	0.80
Phosphoric acid	Trace.
Total	10.70

Gases.	Cubic inches.
Carbonic acid	1.070
Oxygen	1.109
Nitrogen	6.013

This water is not heavily impregnated with mineral ingredients, yet when taken in sufficient quantities it exerts an undoubted influence on the physical economy. It has been found to possess antacid, mild aperient, and tonic effects. Its clear and sparkling appearance and freedom from organic impurities qualify it for table and domestic purposes. It is said to have been found fresh and palatable after three years' bottling. The water is used commercially.

CRESSON SPRINGS,

CAMBRIA COUNTY.

Post-office, Cresson. Hotel and cottages. Access: Cresson is a station on the Pennslyvania R. R., two hundred and fifty miles west of Philadelphia and one hundred and two miles east of Pittsburg. Through sleeping-car tickets may be purchased from all importart points.

On the summit of the Alleghany Mountains, 2300 feet above the sea-level, is located the charming and picturesque resort known as

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[1] Converted from parts per 1,000,000.

Cresson Springs. This lovely spot has been abundantly endowed with nature's choice attractions, and it is at once a resting place for the weary and a sanitarium for the weak in body. The bracing mountain air is in itself a speedy antidote to many of the lesser ills of life, and it is said that the early stages of pulmonary trouble are quickly arrested by a sojourn here. The Mountain House, adjoining the springs, is a structure of imposing proportions and built with a special view to its fitness as a hotel. Its sanitary arrangements are excellent, and it is properly equipped with all the comforts, conveniences and luxuries of the day. The building is located in a handsome park of magnificent forest trees. The grounds cover an area of four hundred acres, much of which is devoted to lawn, garden, and groves. Adjacent to the hotel are a number of cottages, which may be rented by those who prefer a more home-like seclusion than is attainable in a large hotel. The hotel and its surroundings furnish ample scope for amusement and diversion. Lawn-tennis, croquet, rambles through the woods and mountains, and driving are among its outdoor diversions. During the season daily observation cars are run between Cresson and Altoona, and several times each week between Cresson and Ebensburg, affording to excursionists some of the finest mountain scenery in the country. The romantic beauty of the famous Horseshoe Curve, the inspiring grandeur of the Old Portage Road, the wild charm of the Allegrippus, and endless vistas formed of forest crowned peaks and leafy valleys excite the admiration of every lover of nature. Two of the springs at Cresson have been analyzed by Prof. F. A. Genth, of the University of Pennsylvania, with the following results :

MAGNESIA SPRING (CRESSON SPRINGS).

Mild Alkaline.

One U. S. gallon contains :

Solids.	Grains.
Calcium sulphate	0.11
Magnesium chloride	0.56
Calcium chloride	1.30
Sodium chloride	1.23
Iron bicarbonate	0.02
Manganese bicarbonate	Trace.
Magnesium bicarbonate	0.41
Calcium bicarbonate	0.02
Sodium bicarbonate	1.43
Potassium bicarbonate	0.21
Calcium phosphate	Trace.
Alumina	"
Silicic acid	0.91
Nitrous acid	Trace.
Carbonic acid (free)	0.66
Total	6.86

This water is somewhat aperient in full doses. It also possesses reconstructive and tonic properties.

PURE SPRING (CRESSON SPRINGS).

Indifferent.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	0.04
Calcium carbonate	0.35
Magnesium carbonate	0.24
Iron carbonate	0.02
Sodium carbonate	0.12
Potassium carbonate	0.08
Sodium chloride	0.16
Silica	0.25
Phosphoric acid, Manganese oxide,	Traces.
Total	1.26

Carbonic acid (free and partially combined), 1.40.

This spring is entirely free from organic matter. It emerges in considerable volume from a group of crushed strata formed almost exclusively of silicious elements. It is but slightly mineralized, however, and may be referred to the indifferent group of waters.

FRANKFORT MINERAL SPRINGS,

BEAVER COUNTY.

Post-office, Frankfort Springs. Hotel and cottages. Access *via* Pittsburg, Chicago, Cincinnati and St. Louis R. R. (Pennsylvania system) to Burgettstown, and thence by private conveyance to the springs, nine miles distant.

The location of the Frankfort Springs is 1300 feet above the sea-level and in one of the most picturesque sections of Pennsylvania. The surrounding hills are well covered with pine and oak forests. The atmospheric conditions during the summer months are of a very desirable character, the average temperature being 65° F. The inn has been thoroughly refurnished, and the visitor can enjoy the same advantages of comfort, convenience, and good service that characterize a well-kept city hotel. The springs are three in number, and flow 500 or 600 gallons hourly, the water having a temperature at the springs of 58° F. Mr. E. H. Elliot, the manager, furnishes the following analysis of one of them by an anonymous chemist:

FRANKFORT MINERAL SPRINGS.

Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Iron sulphate	0.43
Iron chloride	1.55
Calcium carbonate	3.33
Calcium chloride	1.99
Calcium sulphate	1.08
Magnesium sulphate	0.60

One U. S. gallon contains:

Solids.	Grains.
Magnesium chloride	1.09
Magnesium carbonate	1.04
Sodium carbonate	2.07
Sodium chloride	1.42
Sodium sulphate	1.00
Potassium carbonate	0.40
Potassium chloride	0.57
Potassium sulphate	0.25
Silica	0.83
Organic matter	0.88
Total	18.53

Carbonic acid gas, 2.39 cubic inches.

This water has been found beneficial in anæmia and rheumatic conditions. The other springs are said to be of a somewhat different chemical composition.

GAYLORD AND GULICK MINERAL SPRINGS,

(Formerly Blossburg Mineral Springs.)

TIOGA COUNTY.

Post-office, Blossburg. Hotels in village. Access *via* Tioga branch of Erie R. R. to Blossburg; also *via* Northern Central R. R. to Roaring Branch, and thence by stage line over the mountains.

These springs are located in a picturesque mountain region 1500 feet above the sea-level. They are surrounded by a charming tract of woodland containing two hundred and thirteen acres, from which a fine view of the valley of the Tioga may be obtained. The place offers many attractions as a summer resort, but is not fully developed as yet. The springs are two in number, and flow about 1800 gallons of water per hour. The following analysis was made by Prof. F. A. Genth, in 1879:

GAYLORD AND GULICK MINERAL SPRINGS.

Sulphated. Acid-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	13.10
Calcium sulphate	23.13
Lithium sulphate	0.12
Sodium sulphate	0.27
Potassium sulphate	0.24
Sodium chloride	0.10
Manganese sulphate	1.83
Cobalt sulphate	0.03
Nickel sulphate	0.36
Aluminium sulphate	6.58
Iron sulphate	31.31
Iron phosphate	0.32
Sulphuric acid	5.64
Silicic acid	2.15
Total	85.18

This analysis shows a sulphated acid chalybeate water of great potency. It is remarkably rich in ferruginous ingredients, and contains a considerable proportion of the sulphate of magnesia and Epsom salt. The analysis also shows appreciable quantities of the rare ingredients manganese, nickel, and cobalt. The water possesses excellent properties as a tonic and reconstructive, and has been found very useful in conditions characterized by anæmia and general debility. It is also used in dyspepsia and intestinal disorders. Locally it has decided astringent and stimulant effects, and as such is recommended as a douche, spray, gargle, or lotion. The water is used commercially. A mineral water of this strength should always be taken under the direction of a physician.

*GETTYSBURG SPRINGS,

ADAMS COUNTY.

Post-office, Gettysburg. Hotels. Gettysburg is reached by the Philadelphia and Reading and by the Western Maryland Railroads (separate depots). The springs are easily accessible by street-car or omnibus.

Two prominent springs, known as the Gettysburg "Katalysine" and the Gettysburg "Lithia" Springs, are reported by the Government Geological Survey. The following remarks refer to the former, as we have not been able to gain any recent information concerning the lithia springs. The Katalysine Springs are located in a picturesque valley a short distance west of the town. It is said that the great battle of Gettysburg began in the immediate vicinity (Walton). The following analysis of the Katalysine water was made by Prof. Genth, of Philadelphia:

GETTYSBURG KATALYSINE SPRINGS.

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	0.22
Magnesium carbonate	0.33
Iron carbonate	0.02
Manganese carbonate	Trace.
Calcium carbonate	5.02
Sodium chloride	0.66
Lithium chloride	Trace.
Potassium sulphate	0.21
Sodium sulphate	0,25
Magnesium sulphate	6.78
Calcium sulphate	0.83
Calcium phosphate	Trace.
Calcium fluoride	"
Magnesium borate	0:03
Silicic acid	0.20
Organic matter with trace of nitric acid, etc.	0.70
Impurities suspended in water, like clay, etc.	1.10
Total	16.35

In addition, traces of carbonate of copper, sulphate of strontia, alumina, carbonate of nickel, carbonate of cobalt, and sulphate of baryta have been found.

This water is said to be efficient in gout and rheumatism, and has proved of value in gravel, catarrh of the stomach, and dyspepsia. The combination of an alkali with the salts of lime, as observed in this spring, is a very valuable one. The water is used commercially, returns having been made to the United States Geological Survey as late as 1895.

GLEN SUMMIT SPRINGS,

LUZERNE COUNTY.

Post-office, Glen Summit. Hotel. Access *via* Lehigh Valley R. R., about one hundred and fifty miles from New York and one hundred and twenty-five miles from Philadelphia.

This attractive summer resort is on the summit of the Nescopéc Mountain, 2000 feet above tide-water. The romantic scenery of the surrounding country and its easy accessibility, coupled with an excellent modern hotel, furnished with all the recent improvements, have of late years served to bring the place into well-deserved prominence. The charming surroundings and pure, invigorating mountain air offer an enticing refuge from the toils and cares of city life during the hot weather. Numerous cases are cited of the apparent complete arrest of incipient lung disease after a few weeks spent here. The springs about Glen Summit are of the ascending variety, welling up along the lines of jointing in the Catskill formation from far down in the subterranean recesses below. The temperature of the water is acquired from the rocks at depths sufficient to be beyond the influence of surface temperatures, and is cold enough to cause an unpleasant chill to the hands when submerged for a few seconds. An examination, however, will show that these waters owe their value rather to their purity and palatability than to their chemical ingredients. The following analysis was made by Prof. W. H. Dean, chemist, of Wilkesbarre, in 1896:

GLEN SUMMIT SPRING.

Neutral.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.23
Calcium sulphate	0.20
Calcium carbonate	0.20
Silica	0.11
Iron oxide and alumina	0.03
Free ammonia, Albuminoid ammonia, Nitrogen as nitrates, Nitrogen as nitrites,	Traces.
Loss on ignition	0.33
Total	1.10

This shows a very pure and valuable water for domestic uses. Among other excellent pure-water springs in the neighborhood are the "Great Indian" Spring, yielding over 4000 gallons hourly, used for the hotel; the "Twin" Springs, the "Bear" Spring, and the "Counterfeiter's" Spring. There are also other springs which have not been named.

MINNEQUA SPRINGS,

BRADFORD COUNTY.

Post-office, Minnequa. Hotel. Access *via* Northern Central R. R., a connection of the Pennsylvania R. R., forty-one miles north of Williamsport, Pa., and thirty-seven miles south of Elmira, New York.

The Minnequa Springs are located in a rich farming and dairy country, at an altitude of 1500 feet above the Atlantic Ocean. The pure mountain air, romantic scenery, delightful drives, and shaded walks afford abundant opportunities for the enjoyment of outdoor life. The location is within easy driving distance of Mt. Pisga, the highest point in Pennsylvania. The hotel at Minnequa is a commodious structure, containing 10,000 feet of wide verandas, and is well fitted with steam heat, electric bells, elevators, etc. In the building the visitor will find a post-office, telegraph office, and railroad ticket office. Many well-known New York and Philadelphia families have their summer homes in the neighborhood. The mineral springs are three in number, and yield about 600 gallons per hour. The waters have been examined by several chemists, the following most recent analysis having been made by Charles M. Cresson, M.D., of Philadelphia:

MINNEQUA SPRINGS.

Light Alkaline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Calcium	0.99
Magnesium	0.20
Sodium	0.72
Lithium	Trace.
Aluminium	0.12
Iron	Trace.
Manganese	0.23
Chlorine	0.14
Silica	0.70
Zinc	0.03
Carbonic acid	2.05
Boric acid	2.13
Oxygen (with silicates)	0.14
Loss	0.15
Total	7.60

It will be observed that the terms of this analysis are expressed in the radicals found. The combinations would be made up of carbonates and chlorides. An analysis of one of the springs by Dr. Gregg some years ago showed the presence of sulphate of potassium and hydrogen sulphide. The waters of these springs have been used for medicinal purposes since the early settlement of this region. They are mildly antacid, tonic, and diuretic in their action. Owing to the presence of zinc and manganese they have been recommended by some physicians in the treatment of certain nervous affections, including epilepsy and chorea.

MOUNTAIN SPRINGS,

Lancaster County.

Post-office, Ephrata. Hotel. Access *via* Reading R. R. Trains leave Reading Terminal, at Twelfth and Market Streets, Philadelphia, daily, except Sundays, at 10 A.M. and 4 P.M., arriving at springs at 12.44 and 6.45 P.M.

This pleasant resort is located on the western slope of the Ephrata Mountain, one of the highest points of land in Lancaster County. Many charming features of climate and scenery are united here. The visitor will find pure air, a comfortable and well-kept hotel, excellent fishing, and delightful surroundings at this summer resting-place. The water of the Mountain Springs is celebrated for its purity and sparkle. It has not been analyzed, but we are credibly informed that it contains iron and carbonic acid gas. The springs discharge about 3000 gallons per hour.

PARKER MINERAL SPRING,

McKean County.

Post-office, Gardeau. Hotel and sanitarium. Access: Gardeau is a station on the Western New York and Pennsylvania R. R., four passenger trains daily stopping at this point.

This resort is located in the Alleghany Mountains, on the headwaters of a branch of the Susquehanna River. The elevation here is about 2000 feet above the sea-level. The country in this part of Pennsylvania is still wild and sparsely settled. Dense forests of hemlocks are frequent, and bear and deer may yet be found to reward the hunter's pursuit. Mountain trout streams abound, and if the disciple of Izaak Walton chooses to follow their wanderings into the dark recesses of the woods he need not return with an empty basket. It need not be said that the climate in this wild and rugged region is bracing and salutary. In 1865 the present mineral well was drilled on the site of an oil spring. At 650 feet a vein of water was struck that flows from the top of the well in an unvarying current about 70 gallons per hour. After some delay a bath-house, sanitarium, and hotel were built, and the place has developed into a very comfortable and attractive resort. An analysis of the water by Henry Trimble, analytical chemist, of Philadelphia, resulted as follows:

PARKER MINERAL SPRING.

Muriated-saline. Calcic.

One U. S. gallon contains:

Solids.	Grains.
Magnesium chloride	109.84
Calcium carbonate	11.95
Calcium chloride	221.92
Sodium chloride	282.55
Potassium chloride	Traces.
Silica	1.33
Total	627.59

Temperature of water at spring, 50° F.

This is a richly impregnated saline water of the magnesic-sodic-calcic variety. When used under proper medical supervision it ought to exert a very beneficial influence in a variety of disordered states of the physical economy. It should always be commenced in small quantities. The water has been found to possess active cathartic and diuretic properties. It is also a stimulant to the gastric mucous membrane, promoting the flow of gastric juice and aiding the process of digestion. The best effects of the water will be observed in atonic dyspepsia, torpor of the liver, abdominal venosity, constipation, in nephritis with scanty, high-colored urine, and in irritable states of the bladder. At the resort it is also used in the form of baths in a variety of conditions. The water is bottled and shipped to any desired point.

PAVILION SPRING,

BERKS COUNTY.

Post-office, Wernersville. Sanitarium. Access *via* Bound Brook route, Central R. R. of New Jersey, Lebanon Valley R. R., or Philadelphia and Reading R. R. to Wernersville; thence one and three-quarter miles by private conveyance to spring.

The Pavilion Spring is not itself a resort, but its waters are used commercially, and locally it is used to supply the Grand View Sanitarium. It is located on the grounds of the sanitarium, near Wernersville, and nine miles from the city of Reading. The situation of the sanitarium is on the South Mountains, about 1000 feet above tide-water, in the midst of charming and picturesque surroundings. This institution is an old and well-known health resort, having been established in 1847. The buildings have been greatly enlarged and improved recently, and the resort is now fitted up with all kinds of appliances and conveniences for combating morbid conditions, being supplied with all varieties of baths, the various means of employing electricty, the Swedish movement, massage, etc.

The Pavilion Spring was analyized in 1885 by Prof. Otto Luthy, analytical chemist, of Philadelphia:

PAVILION SPRING.

Neutral.

One U. S. gallon contains: Solids.	Grains.
Potassium sulphate	0.18
Sodium sulphate	0.02
Sodium chloride	0.06
Sodium carbonate	0.33
Calcium carbonate	0.23
Magnesium carbonate	0.12
Iron oxide and alumina	Trace.
Silica	0.94
Organic and volatile matter	0.10
Total	1.98

This water is very lightly mineralized, containing, indeed, fewer solid ingredients than that supplied to many of our larger cities It is remarkably pure, however, and well adapted for bar and table purposes. The water contains a considerable amount of carbonic acid gas and atmospheric air.

PONCE DE LEON SPRINGS,

Crawford County.

Post-office, Meadville. Access *via* Erie R. R., or by Pittsburg, Shenango and Lake Erie R. R. to Meadville (separate depots); thence about two miles to springs.

The Ponce de Leon Springs may be said to be in a process of development. An electric line of railway from Meadville is under process of construction, and a modern first-class hotel will soon be built. The location is very favorable for a pleasant summer resort, being 1200 feet above the sea-level and surrounded by picturesque hills. There are six mineral springs, only one of which has been submitted to a quantitative examination. An analysis by Prof. Henry Leffmann, of Philadelphia, resulted as follows:

PONCE DE LEON SPRINGS.

Alkaline-carbonated.

One U. S. gallon contains:[1] Solids.	Grains.
Sodium sulphate	0.17
Sodium chloride	0.90
Calcium bicarbonate	1.89
Magnesium bicarbonate	0.47
Sodium bicarbonate	16.73
Silica	0.70
Total	20.86

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[1] Reduced from grains per imperial gallon.

A second analysis by J. Tingley, Ph.D., Professor of Chemistry in the Western Pennsylvania Medical College, of Pittsburg, resulted substantially as above. The following gases were also found:

Gases.	Cubic ins. per gallon.
Carbonic acid	1.33
Oxygen and nitrogen	7.23
Hydrogen sulphide	Abundant traces.

The water is a bland antacid and diuretic. It will be found of value in certain stages of Bright's disease, especially when the urine is scanty, high-colored, and irritating. It is also useful in assisting the diminution of uric acid in gout and gravel, and calcareous deposits. The water will speedily relieve acidity of the stomach and heartburn. It is used commercially, and also for the manufacture of a number of temperance beverages.

ROSSCOMMON SPRING,

MONROE COUNTY.

Post-office, Wind Gap. Hotel. Access: From Philadelphia *via* Reading R. R; from New York *via* Central R. R. of New Jersey. The Rosscommon Depot is only a few hundred feet from the hotel.

The summer resort known as Rosscommon is situated in the Wind Gap of the Blue Ridge Mountains, on the north incline of the range, 1000 feet above tide-water. The location is fifteen miles west of the Delaware Water Gap, twelve miles from Stroudsburg and fifteen miles from Easton. The hotel, known as the Rosscommon Inn, is situated on a handsome plateau, half a mile square, and surrounded by forests. The neighborhood is entirely free from malaria and mosquitoes, and a fine breeze prevails almost constantly—hence the name Wind Gap. The accommodations at the inn are plain and unpretentious, but very comfortable and home-like. The spring, discovered a few years ago, adds considerable to the attractions of the place. The water flows from a fissure in the rock at the bottom of the spring, and constantly discharges a large volume of carbonic acid gas. It was analyzed in 1887 by Prof. William H. Chandler, of the Lehigh University, with the following result:

ROSSCOMMON SPRING.

Neutral (Lightly Carbonated).

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.08
Sodium sulphate	0.09
Potassium sulphate	0.05
Magnesium sulphate	0.02
Calcium carbonate	0.39
Magnesium carbonate	0.10
Iron carbonate	Trace.
Silica	0.47
Total	1.20

Carbonic acid gas (free and partially free), 1.42 cubic inches.

This analysis does not present a mineral water in the strict acceptation of the term. It is probable that very few common potable waters would show so light a mineralization; yet it is exceedingly pure, and has sufficient gas to give it a bright sparkle and to render it very palatable. It is an excellent drinking water and well adapted for club and domestic purposes, being entirely free from organic impurities. It is also valuable for general use in the sick room, and is said to exert a favorable influence in certain kidney, bladder, and stomach disorders. This beneficial effect, however, is probably due more to the wholesomeness and purity of the water itself than to its mineral ingredients. The water is bottled and sold.

SAEGERSTOWN MINERAL SPRINGS,

(*Formerly Eureka Springs.*)

CRAWFORD COUNTY.

Post-office, Saegerstown. Hotel and sanitarium. Access *via* main line of the Erie R. R. to Saegerstown, six miles east of Meadville.

Saegerstown is situated on the historic Venango River, now called French Creek, in a beautiful and healthful valley, 1200 feet above the ocean level. The scenery here is of a charming rural character, and the surroundings offer excellent opportunities for fishing, rowing, hunting, driving, bicycling, etc. The sanitarium is a large and commodious building, having all the modern conveniences of a hotel combined with facilities for the care and treatment of invalids. The grounds are tastefully laid out, and include spaces for croquet, lawn-tennis, and other games. A billiard-room and bowling alley have been fitted up for the guests of the house, and during the busy season an orchestra will furnish music in the evening hours. The hotel is open the entire year. There are two mineral springs at Saergerstown, issuing from a bed of rock about 300 feet deep. An analysis made in 1896 by W. H. Dean, analytical chemist, of Wilkesbarre, showed the following chemical ingredients of one of the springs:

SAEGERSTOWN MINERAL SPRINGS.

Saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	7.46
Sodium sulphate	0.62
Potassium sulphate	0.22
Calcium sulphate	4.33
Calcium carbonate	3.26
Magnesium carbonate	2.85
Iron oxide and alumina	0.15
Total	18.89
Loss on ignition	4.17

The water is free from nitrates and nitrites or other organic impurities, and will keep indefinitely without undergoing impairment of mineral properties. The water is bottled and shipped to all points. It will be found useful in the diseases benefited by this class of waters. Elaborate bathing facilities are supplied to visitors at the springs.

THREE SPRINGS,

HUNTINGDON COUNTY.

Post-office, Three Springs. Hotels and sanitarium. Access: Take the Pennsylvania R. R. (main line) to Mount Union, Pa.; thence take East Broad Top R. R. to springs.

The village of Three Springs is located in a valley formed by Jack's Mountain, 2220 feet high, and Cave Hill, 2210 feet in altitude. The place takes its name from the presence of three mineral springs, situated about one hundred feet apart, and forming the corners of an equilateral triangle. The springs are known as "No. 1," "No. 2," and "No. 3." They have been known and used for many years, but it was not until 1891 that they came under the control of the present proprietor, who has brought them to an advanced state of development as a resort. Spring No. 1, the most important of the group, flows about 1000 gallons of water per hour, having a temperature of 55° F. It is used commercially under the name of the Hygeia Natural Mineral Water, and is shipped in five-gallon demijohns. The following analysis was made in 1895 by Prof. G. G. Pond, of the Pennsylvania State College:

SPRING NO. 1 (THREE SPRINGS).

Sulphated-saline. Calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium bicarbonate	34.00
Calcium sulphate	53.63
Magnesium sulphate	33.54
Sodium sulphate	5.91
Sodium chloride	0.35
Lithium sulphate	0.02
Potassium sulphate	Trace.
Silica	1.15
Total	128.60

Gases.	Cubic inches.
Carbonic acid	5.47
Oxygen	1.72
Nitrogen	3.85

The water is bright, sparkling, and palatable, and entirely free from organic impurities. It is an efficient laxative and mild diuretic, and has been found beneficial in cases where activity of the emunctories is desirable. The water has been used with success in cases of obesity and in uræmia and general anasarca, as well as in local dropsies. In habitual constipation a systematic course of the water is often curative. It is also beneficial in other disorders requiring a sulphated saline water. The sanitarium at Three Springs is kept open all the year.

TUSCARORA LITHIA SPRING,

JUNIATA COUNTY.

Post-office, McCoysville. We are informed by Mr. W. A. Middleton, mineralogist, of Harrisburg, that this valuable lithia water was discovered by prospectors, a few years since, while boring for oil. The spring flows about 400 gallons per hour, and is heavily charged with carbonic acid gas. It contains the following solids :

- Potassium bicarbonate.
- Calcium bicarbonate.
- Lithium bicarbonate.
- Magnesium bicarbonate.
- Magnesium sulphate.
- Sodium sulphate.
- Silica.
- Alumina.

The water is of the alkaline class, and is free from nitrates and nitrites. As far as can be learned, the spring is not yet fully developed as a resort, but the water is sold.

WHITE SULPHUR SPRINGS,

BEDFORD COUNTY.

Post-office, Mann's Choice. Hotel and annex. Access *via* Pennsylvania R. R. to Sulphur Springs Station; thence one and one-half miles to springs.

This lovely retreat among the pine-clad mountains is situated in Milligan's Cove, ten miles southwest of Bedford. The location is 1500 feet above the sea-level, and the climate and scenery very similar to that at Bedford Springs. The springs are two in number, and situated about fifteen feet apart. The large spring yields about 200 gallons and the smaller 90 gallons per hour. The water has an unvarying summer and winter temperature of 48° F. This analysis was made in 1882 by Prof. F. A. Genth :

WHITE SULPHUR SPRINGS.

Sulphated-saline. Alkaline-calcic.

One U. S. gallon contains :

Solids.	Grains.
Calcium carbonate	5.58
Magnesium carbonate	1.29
Iron carbonate	0.43

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	0.54
Calcium sulphate	0.35
Magnesium sulphate	0.98
Sodium sulphate	1.00
Potassium sulphate	0.22
Calcium phosphate	Trace.
Sodium chloride	0.19
Lithium chloride	Trace.
Silicic acid	1.81
Carbonic acid	1.29
Hydrosulphuric acid	0.06
Total	13.74

The hotel is a spacious structure, surrounded by broad verandas and neatly and comfortably furnished. The popularity of the resort is said to be steadily increasing, and visitors now come from all parts of the country during the season

*YORK SULPHUR SPRINGS,

ADAMS COUNTY.

Post-office, York Sulphur Springs. Hotels. Access *via* Pennsylvania R. R. (Hanover branch) to Oxford Station, ten miles east of Gettysburg; thence nine miles by stage to springs.

This is one of the old Pennsylvania spring resorts. It has been popular with citizens of Baltimore since the discovery of the springs in 1790. The waters were analyzed many years ago, but the analysis is inaccurate. The springs are two in number.

The following Pennsylvania springs are also used as resorts to some extent:

Doubling Gap White Sulphur Springs, near Newville, Cumberland County; five in number; sulphureted and chalybeate.

McElroy's Spring, Westmoreland County; chalybeate.

Wildwood Springs, Loretto, Cambria County; three in number; chalybeate.

Wolford's White Sulphur Springs, Wolford's Gap, Bedford County.

Yellow Springs, Adams County.

The following additional springs report sales of water:

Aquetong Mineral Spring, Aquetong, Bucks County.

Gray Spring, Cambridgeborough, Crawford County.

Pulaski Natural Mineral Springs, Pulaski, Lawrence County.

Susquehanna County Mineral Springs, Rush, Susquehanna County.

There are also a number of minor local spring resorts in the State as well as several undeveloped springs.

RHODE ISLAND.

The State of Rhode Island is located between the parallels of 41° 18′ and 42° 5′ north latitude, and 71° 8′ and 71° 53′ west longitude. It is shut in on the east and north by Massachusetts and on the west by Connecticut, while its southern shores are washed by the Atlantic Ocean. Including Narragansett Bay, the State has a water frontage of 350 miles. The surface of the State is broken and hilly, without being mountainous. The principal rivers are the Pawtucket, an affluent of the Providence, noted for its falls and great water-power; the Pawtuxet, a beautiful stream rising in the northern part of the State and entering Narragansett Bay; and the Pawcatuck, a small stream that forms the western boundary for about ten miles. The climate of the State, though variable, differs from that of the exposed coast of Massachusetts Bay in the absence of harassing east winds, while the proximity of the southern parts of the State to the Gulf Stream results in an atmosphere of unusual warmth and moisture and comparative equability. The mean annual temperature at Providence is 47.91° F., and at Newport 49.39° F., and the mean annual rainfall varies from 40 inches in the eastern part to 44 in the west. The State includes within its limits many beautiful and attractive summer resorts, prominent among which are Newport, the "Queen of American watering-places;" Narragansett Pier, and Block Island, some distance off the coast.

According to the last national census returns, the mortality-rate in Rhode Island was 21.88 per 1000 of population. The death-rate from consumption was 2.67 per 1000 of population.

Rhode Island is not credited with mineral springs in any of the previous works on the subject. There are, however, several springs in the State, although none of them has come into much prominence so far. Complete analyses would probably show that most of them are chalybeate, as the magnetic oxide of iron is an important element in the geological formations of the State.

DARLING'S MINERAL SPRINGS,

PROVIDENCE COUNTY.

Post-office, Pawtucket. The following entertaining account of these springs was sent to us by the L. B. Darling Fertilizer Company, of Pawtucket:

"Strangers in Pawtucket, and probably many of the residents, have very likely wondered why a certain street is named 'Mineral Spring Avenue,' and why a certain cemetery bears the name of 'Mineral Spring Cemetery.' Mineral Spring Avenue runs from Main Street, near Collyer Park, through the localities known as Woodlawn and Lorraine, to the North Providence line and beyond Mineral Spring Cemetery. Mineral Spring Cemetery lies to the north of Mineral Spring Avenue, and no doubt takes its name from the avenue, while the avenue in turn takes its name from a mineral spring a short distance south of the avenue, out beyond the Lorraine Mills. This spring has tried hard to become famous and to create a famous locality, but did not succeed. In 1820 or thereabout one Comstock owned the property, and built a house at and partially over the spring, with the intention of making it a resort for invalids who might desire to drink the water, and for some time it was used for that purpose, but it did not flourish in that character. In June, 1827, George Robinson, Jr., notified the public that he had lately taken charge of the Mineral Springs in North Providence (as Pawtucket was then called); that the place had undergone thorough repair, etc., and that he was prepared to accommodate parties with every variety of refreshments, and was making ample arrangements for the Fourth of July, when a clam-bake would be served. The waters of the spring were declared to be extremely healthful, and had been found very efficacious in a variety of diseases, and contained chalybeate intermingled with particles of sulphur. The romantic situation of the springs and their proximity to Pawtucket, it was believed, would make them a popular place of resort. It appears that Mr. Robinson's enterprise did not meet with the success that he had hoped for, as in September, 1830, the place was advertised to be let, and the furniture of the establishment, new and in good order, was advertised to be sold. In May, 1831, Iram Heywood announced that he had taken the Mineral Springs Hotel and was 'prepared to entertain company at the well-known stand.' A shower-bath was about to be erected, and other additions were to be made. It was stated that two superior bowling alleys were attached to the establishment. But this was never much of a success as a public house. Nearly or quite half a century ago the property came into the hands of Lucius B. Darling, who started what are now known as the 'fertilizer works,' back of and a little distance from the house. For some time the spring was neglected, although many were in the habit of going there to drink the water and even to carry it away for drinking purposes. The wood around it rotted away, and things went to pieces generally, so that it was difficult to get at the water. In 1866 a resident of Pawtucket, who had drunk of the water for forty years and believed that he was deriving much benefit from its use, asked permission of Mr. Darling to repair the surroundings of the springs. This called Mr. Darling's attention to the matter, and he promptly put the spring into convenient shape. New stairs leading to the spring were constructed; it was surrounded by stone walks laid in cement, and a headless barrel was set up, into which the water boiled continuously. At that time a great many people went there for the water, which was believed to be as good as any of the waters of Saratoga, while it tasted better. The headless barrel still stands there, and the water boils up out of the ground as freely to-day as it did thirty, forty, fifty, or more years ago, and to-day the spring is visited by many people who go there for the water, who drink it there, and who carry it away in bottles, jugs, and demijohns, believing that the water has medicinal properties. Besides this, many people go there daily, and especially on Sunday, to drink of the water—not because of any chemical virtue it may have, but because it is good, cool water, and pleasant to drink. Day in and day out the water boils up in that headless barrel, and runs away steadily in an inch and a quarter stream into a place made in the stone surroundings, and thence into the Moshassuck River. The stones upon which the water falls as it comes from the barrel have an iron-rust appearance, but aside from this there are no indications of iron around the spring. . . . There has been an analysis of the water in years gone by, but it has been lost, or at least its whereabouts are unknown to any who are at present interested in the spring."

Thus runs the pathetic story of this ancient fountain, which has many counterparts in the older sections of our country. There are other springs in the neighborhood, but the one above described seems to be the only one ever suspected of possessing mineral qualifications.

GLADSTONE SPRING,

WASHINGTON COUNTY.

This spring is located at Narragansett Pier. A sanitary analysis sent us by Mr. W. A. Nye, the proprietor, shows a very pure and wholesome potable water, but it is evidently very lightly mineralized. It is recommended for table and club uses, but not, so far as we can learn, for medicinal purposes. The water is bottled and sold.

HOLLY SPRING,

PROVIDENCE COUNTY.

Post-office, Woonsocket. This spring is located two miles east of Woonsocket. It was analyzed in 1883 by Edwin E. Calder, with the following results :

HOLLY SPRING.

Neutral.

One U. S. gallon contains: Solids.	Grains.
Calcium carbonate	0.44
Magnesium carbonate	0.25
Calcium sulphate	0.37
Sodium chloride	0.34
Potassium chloride	Trace.
Silica	0.60
Iron oxide and alumina	0.03
Organic and volatile matter	0.47
Loss	Trace.
Total	2.50

This water is used commercially for domestic and club purposes.

OCHEE SPRINGS,

PROVIDENCE COUNTY.

Post-office, Johnston. The Ochee Springs are not properly a health resort, although there are many visitors in pleasant weather. There are a number of springs in the neighborhood, but only one is improved at the present time. The following analysis was made by Prof. John H. Appleton, of Brown University:

OCHEE SPRINGS.

Light Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	1.13
Calcium carbonate	3.20
Calcium sulphate	0.44
Potassium sulphate	0.88
Sodium sulphate	0.41
Sodium chloride	0.57
Iron oxide and alumina	0.75
Insoluble mineral matter	0.58
Organic and volatile matter	0.87
Undetermined	0.15
Total	8.98

This water is pure and wholesome, and is said to act as a mild cathartic and diuretic when used continuously. It was accorded a considerable reputation as an auxiliary in the treatment of kidney, liver, and stomach troubles. The water is used commercially.

Other springs in Rhode Island are as follows:

Cranston Mineral Spring, Cranston Township, Providence County; said to be unimproved.

Cumberland Spring, Cumberland Hill, Providence County.

Warwick Neck Mineral Springs, Warwick Neck, Kent County; chalybeate; unimproved.

SOUTH CAROLINA.

South Carolina extends from 32° to 35° north latitude, and from 78° 35′ to 83° 30′ west longitude. The State is level and marshy along the coast, while the interior and western sections are undulating. The Blue Ridge Mountains extend through the northwestern part. The chief elevations are King's Mountain, 1692 feet; Paris Mountain, 2054 feet; Table Rock, 3000 feet, and Mount Pinnacle, 3436 feet. The mountain region abounds in beautiful and picturesque scenery, rendering it very attractive to tourists. The climate of South Carolina is mild and genial. The sea islands generally, as well as the pine barrens, are healthy, furnishing the planter with a summer home and safe retreat from the malaria of the rice lands. These latter regions are quite unhealthy to the whites in summer. The midlands are salubrious, except here and there along the creeks, while the climate of the mountain region is unexceptionable. The State is noted for its many fruit orchards and for its great variety of valuable wood trees. It is said that the long-leaf yellow pine, confined chiefly to the low country, covers 1,000,000 acres. The mean annual temperature ranges from 60° in the north to 67° in the south. The average annual rainfall is about 45 inches. The death-rate for the State, according to the last census returns, was 13.46 per 1000 of population. The mortality from phthisis was at the rate of 1.83 per 1000 of population.

Mineral springs are abundant in South Carolina, and some of them are quite valuable. They are generally of the alkaline-saline or chalybeate type. Some of the older resorts, well known before the war, have been permitted to languish. With a single exception—the Charleston Artesian Wells—we have secured information of all the localities described in the following account by correspondence with physicians and spring owners in the State and by a personal visit to the State.

AMBLER SPRINGS,

(Formerly Griffin's Springs.)

PICKENS COUNTY.

Post-office, Pickens Court-house. Hotel. These springs are two in number, and are located seven miles from Pickens Court-house, at a level of 2000 feet above the sea. They are used to some extent as a resort, and the water is also used commercially. The Ambler House is one mile from the springs. It is kept open for the reception of guests during the summer months. The following analysis of the water was made in 1895 by M. B. Hardin, chief chemist of the Clemson Agricultural College:

AMBER MINERAL SPRING.

Light Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	0.80
Calcium carbonate	2.15
Magnesium carbonate	0.65
Potassium sulphate	0.51
Sodium sulphate	0.18
Sodium chloride	0.37
Iron sesquioxide and alumina	0.02
Silica	1.78
Total	6.46

It is said that this water is used with advantage in dyspepsia and skin disorders of the eczematous variety.

CHARLESTON ARTESIAN WELLS,

CHARLESTON COUNTY.

Post-office, Charleston. Several artesian wells in the city of Charleston have been found to be impregnated with mineral ingredients. Those mentioned in the Geological Reports are the "Old Artesian Well," the "Citadel Green Well," the "Commercial Cotton Press Well," and "Chisholm's Mill Well." We introduce the following analysis of the first of these, made in 1868 by Dr. C. U. Shepherd, Jr.:

OLD ARTESIAN WELL.

Alkaline. Muriated-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium bicarbonate	71.06
Calcium bicarbonate	0.12
Magnesium bicarbonate	0.02
Sodium chloride	63.38
Silica	Trace.
Organic matter	Traces.
Iron oxide	Trace.
Aluminium oxide	0.79
Carbonic acid	Trace.
Total	135.37

This water has a temperature of 87° F., and is therefore a thermal. The well is 1250 feet deep, and the flow of water is estimated at 1200 gallons per hour. The Commercial Cotton Press Well contains a considerable proportion of sulphate of magnesium.

CHICK'S SPRINGS,

GREENVILLE COUNTY.

Post-office, Greenville. Hotel and cottages. Access *via* Atlanta and Charlotte Air-line (Southern Railway system), to Taylor's Station, ten miles from Greenville; thence one mile to springs.

Chick's Springs are located in a broken, rugged country, about 1200 feet above the sea-level. Paris Mountain, a spur of the Blue Ridge, is only three or four miles distant. The climate of this region is very salubrious and well adapted for pulmonary cases during the winter months. The air is dry, and clear weather with invigorating breezes the rule. The resort has had a wide reputation in the South for many years, but owing to the destruction of the hotel by fire it has not been open to the public until two or three years since, when the present owner built a small hotel and several cottages. A large, new hotel is projected, which, with other improvements, will bring the place up to its old standard of excellence. The springs are two in number, known as the "Iron" and the "Sulphur" Springs, and are about one hundred and fifty feet apart. The following analysis by Dr. Charles U. Shepherd, of Charleston, was sent to us by Mr. Julius C. Smith, of Greenville:

CHICK'S SPRINGS.

Calcic-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	32.57
Magnesium sulphate	0.63
Sodium sulphate	2.37
Sodium silicate	3.69
Potassium silicate	0.31
Silica	0.50
Iron oxide	0.41
Total	40.48

Carbonic acid gas, present in appreciable quantities.

These waters have been found of great advantage in cases of atonic dyspepsia accompanied by hepatic congestion. It is also a useful auxiliary in Bright's disease of the kidneys.

GLENN SPRINGS,

SPARTANBURG COUNTY.

Post-office, Glenn Springs. Hotel and cottages. Access from Spartanburg, a distance of twelve miles, by the Glenn Springs R. R., double daily service.

These springs are located in a charming section of the country, broken by granite and sandstone hills. The elevation is about 1000 feet above the sea-level. Many improvements have recently been added, the hotel having been greatly enlarged and comfortable cottages built. Many additional improvements are under way, and when completed Glenn Springs will bid fair to compete with the leading spas of the country. The following analysis of the Glenn Springs water was made in 1880 by C. U. Shepherd, Jr.:

GLENN SPRING.

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	3.32
Calcium sulphate	91.50
Sodium chloride	2.21
Potassium chloride	0.52
Total	97.55

This analysis is probably incomplete. We are informed that a more recent partial examination of the water showed the presence of lithia in considerable quantities. The water has been in use many years. Numerous well-known physicians of South Carolina attest to its virtues, especially in disorders of the alimentary tract, dyspepsia, diarrhœa, dysentery, hemorrhoids, etc. It is said to be very useful in functional uterine affections, dysmenorrhœa, amenorrhœa, leucorrhœa, etc., as well as in torpidity of the liver and biliousness.

HARRIS LITHIA SPRINGS,

LAURENS COUNTY.

Post-office, Harris Springs. Hotel and cottages. Access *via* Georgia, Carolina, and Northern R. R. (Seaboard Air-line) to Cross Hill; thence two and one-half miles to springs. Or *via* Port Royal and Western Carolina R. R. to Waterloo, and thence two miles to springs.

These springs are located in a hilly country, and are open for the reception of visitors during June, July, August, and September. They are two in number, known respectively as the "Lithia" and the "Sulphur" Springs. They flow about 60 gallons per hour each. The following analysis was made by Prof. R. Ogden Doremus, of New York, in 1891:

HARRIS LITHIA WATER.

Alkaline-calcic. Lithic.

One U. S. gallon contains :

Solids.	Grains.
Calcium sulphate	83.38
Potassium sulphate	0.51
Sodium sulphate	0.58
Sodium chloride	0.76
Sodium bicarbonate	2.42
Lithium bicarbonate	2.32
Magnesium bicarbonate	3.04
Iron bicarbonate	0.32
Silica	2.51
Phosphoric acid	Trace.
Loss on ignition	15.84
	111.68
Total dried residue at 2.66° F.	98.57
Carbonic acid in bicarbonates	3.35
Total solids per U. S. gallon	101.92

The combination of mineral ingredients shown in this analysis would suggest a very useful water. It is highly effervescent and agreeable to the taste. It is therefore useful for the table, and mixes well with wines. It is a speedy corrector of acidity of the stomach. It is said that the water causes a notable reduction of sugar in the urine in diabetes mellitus. It also overcomes constipation, and is useful in rheumatism, uric acid gravel, calculi, etc. The water has an extensive sale.

REEDY CREEK SPRINGS,

MARION COUNTY.

Post-office, Latta. Hotel and cottages. This resort is located about three-quarters of a mile from the Atlantic Coast Line R. R. The surrounding country is level and covered by the long-leafed pine. The springs are three in number, and have had a local reputation for more than thirty years. The water has a constant temperature of 45° F., and its flow is very large. Mr. John L. Dew, of the springs, sends us the following list of ingredients resulting from a partial analysis by former State Chemist Chizzell :

Iron carbonate.	Calcium.
Magnesium.	Sulphur.

The water is used more particularly for stomach, liver, and kidney disorders and debilitated states of the system.

WEST SPRINGS,

UNION COUNTY.

Post-office, West Springs. Hotel and cottages. Access from Spartanburg *via* Glenn Springs R. R., twelve miles southeast, to Glenn Springs; thence four miles southeast to West Springs.

West Springs are located about 2000 feet above the sea-level, and are surrounded by picturesque hills covered by extensive forests of spruce, pine, cottonwood, beech, oak, and other trees. The soil is exceedingly fertile, and many varieties of fruits and vegetables grow in great profusion. Several gold mines are in operation among the nearby hills. There are several springs in the neighborhood, but only one is in use. It yields about 400 gallons of water per hour, having a temperature of 62° F. According to an analysis made in 1893 by M. B. Hardin, analytical chemist, it contains the following chemical ingredients :

WEST SPRINGS.

Alkaline-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	16.26
Potassium sulphate	1.33
Sodium sulphate	2.75
Calcium carbonate	6.35
Magnesium carbonate	1.17
Sodium chloride	0.21
Iron sesquioxide, Alumina,	0.03
Silica	2.78
Organic matter	Trace.
Total	30.88

The water is used considerably by South Carolina physicians in diarrhœa and dyspeptic troubles. It is said to possess excellent virtues in chronic catarrhal conditions of the genito-urinary tract—*i. e.*, gonorrhœa, gleet, leucorrhœa, etc.

The following additional South Carolina springs are also used to some extent as resorts:

Cherokee Springs, eight miles north of Spartanburg, Spartanburg County; chalybeate.

Garrett Spring, one-half mile from Spartanburg, Spartanburg County; calcic, sulphureted.

Some of the old-time resorts of the State have been abandoned, while a number of promising springs have not yet been developed.

SOUTH DAKOTA.

South Dakota extends from 43° to 46° north latitude, and from 96° 22′ 30″ to 104° west longitude. The surface of the State is a rolling prairie serried by numerous watercourses. The Black Hills, situated in the southwestern portion and extending into Wyoming, have a considerable elevation, though none of the peaks exceed 7000 feet in height. In this region are large tracts of pine and other valuable timber, and some of the richest gold and silver mines in the world. A large district between the Big Cheyenne and White Rivers, known as the "Bad Lands," is entirely barren and its surface is fantastically cut up and distorted by the action of wind and water on the blue clay formation. The Upper Missouri divides the State into two nearly equal parts, and forms one hundred miles of its southern boundary. In its circuitous course it receives the waters of the Big Knife, Grand, Moreau, Big Earth, Vermilion, Big Sioux, and other rivers, with their tributaries, none of which are navigable. The State is thickly studded with many beautiful bodies of water, the principal lakes being the Big Stone, Traverse, Long, and Wood. West of the Missouri are many scattered, isolated "buttes," from 500 to 1500 feet high. The Indian reservations take up a considerable portion of the land in this section. The climate of South Dakota, though subject to great extremes, varying from 34° F. in winter to 103° F. in summer, is nevertheless invigorating and healthful. The spring seasons open much earlier than in the Eastern States in the same latitude, and the humidity, as a rule, is much less than along the Atlantic seaboard. Owing to the dryness and the clearness of the atmosphere and the elevation of the surface, malarial diseases are almost unknown, while pulmonary complaints are comparatively rare. The average rainfall is about 27 inches. The mortality-rate in South Dakota, according to the United State census returns of

1890, was 8.22 per 1000 of population. The death-rate from consumption was 0.63 per 1000 of population. There are doubtless a considerable number of mineral springs in South Dakota, but like most of our far Western States they have not yet come into use as resorts. Newton and Jenney, in their report on the geology of the Black Hills, say: "Springs issuing from the black clay shales of the Cretaceous period on Beaver Creek were found to be strongly acid and astringent to the taste, turning blue litmus red, and probably containing alum and free sulphuric acid. Similar springs were reported to be found near Buffalo Gate, on the southeastern side of Black Hills." Springs in the carboniferous rocks of this region are naturally hard, but are not properly classed with mineral springs. By diligent inquiry we have succeeded in obtaining information of one well-developed spring resort in the limits of the State. The following account of the Hot Springs is derived from information supplied by persons living at the resort and from a neat brochure written by W. B. Leffingwell :[1]

SOUTH DAKOTA HOT SPRINGS,

Fall River County.

Post-office, Hot Springs. Numerous hotels and cottages. Access *via* Fremont, Elkhorn, and Missouri Valley R. R. (branch of the Chicago and Northwestern system), or *via* the Chicago, Burlington and Quincy R. R. (Burlington route) direct to Hot Springs, arriving at the same depot by either route.

This magnificent new spa is located in the heart of the Black Hills, at an elevation of 3400 feet above the sea-level. The transformation of this grand and romantic region from the abode of savagery to the familiar aspects of *fin de siècle* civilization has been almost startling in its suddenness. Where hardly more than yesterday the wild beasts roamed at will and fierce aborigines held undisputed sway, we are to-day encountered by the puffing railroad train, the telegraph and telephone office, and schools, churches, and hotels, many of which our long-settled Eastern cities might be proud to claim. The advantages of Hot Springs as a health resort are numerous.

First, as to topographical features.

The scenery in and adjacent to the place is varied and delightful. The lofty, pine-clad hills, grand canyons, rippling streams, and beautiful falls of the Minnekahta and Cheyenne, make up a group of attractions difficult to excel. From the smiling brook to the lofty summit of Battle Mountain the scenery changes at every point, and is a constant source of delight and admiration. The following are a few of the numerous points of interest within easy distance of the springs: Battle Mountain, Panorama Peak, Poet's Point, Minnekahta Falls, Hot Brook, Cold Brook, the Great Wind Cave, and Echo Canyon.

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[1] "The Vale of Minnekahta."

Second, as to climate.

By reason of certain peculiar circumstances of location this resort is favored by very mild, equable atmospheric conditions. Summer days are followed by evenings of delicious coolness, while the autumns are unusually pleasant. During the winter months the temperature has observed an average of 42° F. above zero for the last four years. Situated in the Minnekahta Valley and sheltered on all sides by heavily timbered hills, cold winds and sudden changes of temperature are practically unknown. The winter temperature in the valley is from 20° to 25° higher than in localities only a dozen miles distant. It is said that the protection afforded by the hills is supplemented in no small degree by the millions of gallons of hot water flowing through the valley. During the winter of 1892–1893 Dr. C. W. Hargens, of Hot Springs, kept a record of the temperature for the five months beginning with December 1st and ending with April 1st. This was the coldest winter this country has had for many years. We make the following extracts from his notes :

December, 1892. Snowed once; fall of snow, three-quarters of an inch. Five cloudy days.

January, 1893. Three cloudy days. No snow during the month; average temperature for month, 40° F. For the last two weeks of the month, 50.2° F.

February, 1893. One and one-half days cloudy. Snowed four times, with total precipitation nine-sixteenths of an inch.

March, 1893. Two and one-half cloudy days. Snowed twice. Total precipitation, two-fifths of an inch. Average daily temperature, 50.3° F.

April, 1893. No snow. No storms of any kind. Mild, pleasant weather throughout the month.

The visitor will find the accommodation prepared for his entertainment on a par with the charming scenery and genial climate. The largest hotel, the Evans, is constructed and equipped throughout in accordance with the latest and most approved methods. It is fully up to the standard of the best hostelries of the day. Other excellent hotels are the Gillespie, the Hot Springs, the Catholicon, the Davis, and the Parrott House. Cottages are also at hand for those who desire them. The hills afford attractive spots for camping out.

Adjoining the Evans House, and in full keeping, with elegant and elaborate appointments, is the Evans Sanitarium, containing sixty bath-rooms and embracing all varieties of baths. The Stewart Sanitarium, recently completed, also affords facilities for all kinds of bathing, including an excellent plunge bath. The Catholicon Sanitarium, now under construction, will add another to the attractive retreats of the Hot Springs. This structure, with the bath-house, will have a measurement of 100 by 75 feet, and will contain over one hundred bath-rooms. The plunge bath is one of the prominent features of Hot Springs. It is constructed of stone, wood, iron, and glass, and has one hundred dressing-rooms. The building is seventy-five feet wide and two hundred and fifty feet long, heated by steam and lighted by electricty. The water is at a natural temperature of 96° F. the year round. It increases in depth from three feet at one end to eight feet at the other. The springs at this resort are eight in number. The "Minnekahta" is the name given to a great Indian spring, the word being a synonym for health, pleasure, and recreation. It is said that the waters of this spring were in use by the Sioux and other tribes long before the approach of civilization. The natural temperature of this spring is 98° F. It furnishes the drinking fountain of the Evans House, the Evans bath-house, and the Minnekahta bath-house. An analysis by Prof. Charles B. Gibson, of Chicago, resulted as follows:

MINNEKAHTA SPRING.

Saline-calcic. Thermal.

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	4.32
Sodium sulphate, Potassium sulphate,	25.62
Iron peroxide	Trace.
Sodium chloride, Potassium chloride,	13.79
Calcium sulphate	16.32
Silica	2.46
Total	62.51

The waters are perfectly clear, have a decidedly alkaline reaction, and contain no organic matter. Following are analyses of two of the other springs:

MAMMOTH MINERAL SPRING.

Sulphated (sodic). Saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium sulphate	23.26
Potassium sulphate	5.63
Calium sulphate	36.11
Calcium chloride	5.59
Ammonium chloride	0.02
Magnesium chloride	4.11
Magnesium nitrate	0.30
Magnesium phosphate	0.10
Magnesium carbonate	3.51
Iron sesquioxide	0.15
Alumina	0.27
Silica	1.55
Organic and volatile matter	12.11
Total	92.71

LAKATAH SPRING.

Sulphated-saline-calcic.

One U. S. gallon contains :

Solids.	Grains.
Sodium sulphate	8.82
Potassium sulphate	3.33
Calcium sulphate	16.29
Calcium chloride	8.50
Ammonium chlorine	0.05
Magnesium chloride	3.14
Calcium phosphate	0.31
Magnesium nitrate	0.15
Magnesium carbonate	3.04
Iron sesquioxide	0.26
Alumina	0.02
Silica	1.83
Organic and volatile matter	8.05
Total	53.79

According to the report of the National Association of Railway Surgeons, which visited this resort in 1893, "treatment by the Hot Springs water may be said to stimulate all the secretions and organic functions; to promote digestion and assimilation, and to favor tissue metamorphosis and excretion, thereby relieving internal congestions, stimulating bloodmaking, increasing the appetite, and favoring new and healthy tissues at the expense of the old and inactive." This treatment may, therefore, be confidently recommended in "gout and rheumatism after the inflammatory stage. Neuralgia, especially when depending upon gout; metallic or malarial poisoning, paralysis not of organic origin, neurasthenia; the early stages (only) of Bright's disease; syphilis; functional diseases of the liver; dyspepsia, not of organic origin; catarrhal affections of the respiratory tract . . . and chronic skin diseases, especially of the squamous variety."

Hot Springs is the county-seat of Fall River County, and is located about seventy miles south of Deadwood. The town has a permanent population of about 1500, and a summer population of 3000. Its proximity to extensive pine forests, in addition to the favorable features of location above mentioned, assists in preserving a mild and agreeable climate, and has brought the resort into much favor with persons afflicted with hay-fever, asthma, and incipient phthisis.

The following-named springs of South Dakota are mentioned in the United States Geological Reports :

Acid Springs, on Beaver Creek, Custer County.
Acid Springs, near Buffalo Gate, Custer County.
Artesian Well, at Clarke Centre, Clarke County.
Artesian Well, at St. Lawrence, Hand County.
Mineral Springs, in Bon Homme County; chalybeate.

Mineral Springs, in Fall River County; chalybeate.

Mineral Springs, near Ree Heights, Hand County.

Mineral Springs, thirty miles east of Pierre, Hughes County.

Mineral Springs, at Pierre, Hughes County.

Wessington Springs, Wessington Springs, Jerauld County; chalybeate and sulphureted; used as a resort.

So far as we can learn, only a single spring (one of those at Hot Springs) of South Dakota is used commercially.

TENNESSEE.

The State of Tennessee extends from 35° to 36° 41′ north latitude, and from 81° 45′ to 90° west longitude. In general terms the territory embraced in the State may be described as a great mountain chain on the east, from the foot of which extends a gently inclined plane, intercepted by an elevation, the Cumberland or Carboniferous plateau, and a depression, the central valley. The Appalachian chain, called at this point the Unaka Mountains, separates the State from North Carolina. The highest peaks attain an elevation of about 6000 feet above the sea-level. West of these mountains is the beautiful valley of East Tennessee, and further west yet, rising in a steep elevation to a height of from 800 to 1200 feet above the valley, is the Cumberland plateau. The Mississippi River forms the western boundary, and with the Tennessee and Cumberland and their affluents drain the greater portion of the State. Tennessee is remarkable throughout its limits for its extensive forests and great variety of timber, including almost all of the valuable woods. There is an abundance of beautiful scenery, especially in the mountain districts. The climate of no State in the Union is more salubrious or considered more healthful than that of Tennessee. The heat of the summer is seldom extreme, while the winters are mild, with little snow and ice. The eastern elevation is noted in particular for the purity of the mountain air, while the breezes from the uplands continually moderate the summer heat of the level plains to the west. The mean temperature, as observed at Nashville, is 58.32° F.; that of the summer being 76.32° F. and of the winter 39.67° F. The average annual rainfall is about 45 inches. The mortality-rate for Tennessee, according to the United States census of 1890, was 13.49 per 1000 of population. The death-rate from consumption was 2.06 per 1000 of population.

The mineral springs of Tennessee are numerous, and many of them of considerable importance. Chalybeate and sulphureted waters predominate, although there are several magnesic springs in the State. The following account of the Tennessee springs, which is believed to be the most complete ever published, is derived chiefly from information obtained by personal inquiry and correspondence. We are also indebted to some extent to Killebrew and Safford's *Resources of Tennessee*, to Peale's Reports, to the United States Geological Survey, and to Walton's work on mineral springs, in which Tennessee is credited with three localities.

AUSTIN'S SPRING,

WASHINGTON COUNTY.

This spring is located on the banks of the Watauga River, five miles from Johnson City. It is not at present open to the public. The following analysis by Dr. Alpheus Dove, analytical chemist, shows its mineral ingredients :

AUSTIN'S SPRINGS.

Sulphated-saline-chalybeate.

One U. S. gallon contains :

Solids.	Grains.
Magnesium sulphate	11.20
Calcium sulphate	4.80
Sodium sulphate	2.40
Iron sulphate	6.40
Iron oxide	11.20
Calcium carbonate	3.20
Sodium chloride	0.80
Aluminium	2.00
Iodine	Trace.
Loss	4.00
Total	46.00

The analysis shows a very strong chalybeate water, with laxative and cathartic properties.

AVOCA SPRINGS,

SULLIVAN COUNTY.

Post-office, Bristol. Small hotel. Access from Bristol *via* Bristol, Elizabeth and North Carolina R. R.; also by turnpike.

These springs are located six miles from Bristol, from which point they receive many visitors daily during the season. The aspect of the surrounding country is mountainous, the location being 1650 feet above the sea-level. The springs are three in number, and are known as the "White Sulphur," flowing 30 gallons an hour; the "Chalybeate," flowing 10 gallons hourly; and the "Limestone" Spring, flowing 2000 gallons hourly. No analyses have been made. The chalybeate water is said to be a fine tonic, while the sulphur spring has a considerable reputation as an adjunct in the treatment of renal diseases. No special remedial value is claimed for the limestone spring.

BEERSHEBA SPRINGS,

GRUNDY COUNTY.

Post-office, Beersheba. Hotel. Access *via* Nashville, Chattanooga and St. Louis R. R. to Tullahoma; thence thirty-four miles northeast by the Sparta branch line to McMinnville; thence about twelve miles by stage.

These springs are located in a wild and romantic region near the summit of a spur of the Cumberland Mountains. The climate is very salubrious in this section, and the scenery exceedingly attractive. The water has never been analyzed, but is said to be a fine chalybeate. Temperature of water, 58° F.

CROCKER SPRINGS,

(*Formerly White Creek Springs.*)

DAVIDSON COUNTY.

Post-office, Cole Building, Nashville, care of A. G. Goodlet. Hotel destroyed by fire, but accommodations for a few visitors.

This resort is situated twelve miles west of Nashville, at the foot of a high pleateau running north from the Cumberland River to the Kentucky line. The altitude is about 600 feet above the sea-level. The surrounding country is broken, the springs being situated between high hills. The large hotel was destroyed by fire some years since, so that the present accommodations are not what may usually be expected at first-class watering-places. There are, however, several comfortable buildings for the reception of guests. Adjoining the springs is a tract of two hundred acres, containing fine orchards of apple, pear, and peach trees, etc. The prevailing meteorological conditions are clear weather and sunny days, with an atmosphere free from malarial or miasmatic influences. Two springs are in use, one known as the "Black Sulphur," temperature 58° F., and the other as the "Red Sulphur," temperature 56° F. The following analysis was made many years ago (1841) by Dr. Troost, analytical chemist:

CROCKER SPRINGS.

Sulphated-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	35.42
Sodium sulphate	13.20
Calcium sulphate	19.64
Magnesium sulphate	19.32
Sodium hyposulphate	6.50
Total	94.08
Gases.	**Cubic inches.**
Carbonic acid	37.99
Sulphureted hydrogen	40.25

These waters have been well known in Tennessee for their beneficial effects in hepatic congestion, indigestion, Bright's disease, and the uric-acid diathesis.

Within two hundred or three hundred yards of the building is a cold limestone spring which flows from a cave having a remarkably low temperature. The cave is utilized as a natural cold-storage house.

DIXIE SPRINGS,

KNOX COUNTY.

Post-office, Knoxville. Hotels in Knoxville. The Dixie Mineral Spring is an artesian well one hundred and eighty-five feet deep, located just across the Tennessee River, now in the city limits of Knoxville. The location is on the northern slope of the foothills and about 1000 feet above the sea-level. The situation of the spring is a charming one, and commands a magnificant view for miles up and down the beautiful Tennessee valley. The water was struck after boring one hundred and eighty-five feet through solid rock. It has a temperature of about 58° F. the year round. The following analysis was made by J. W. Slocum, analytical chemist :

DIXIE MINERAL WATER.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	14.90
Sodium chloride	110.35
Sodium sulphate	9.70
Sodium bicarbonate	146.91
Potassium nitrate	0.60
Lithium chloride	Trace.
Magnesium carbonate	23.30
Magnesium chloride	0.54
Magnesium sulphate	6.18
Iron carbonate	0.60
Alumina	0.30
Silica	0 36
Total	313.74

This analysis shows an exceedingly valuable water of the alkaline-saline-muriated variety. It resembles the Vichy and Seltzer Springs of Saratoga, but contains less lime than those celebrated waters. This water has been found very useful in dyspepsia, biliousness, and constipation. The water has diuretic, laxative, antacid, and also mild tonic effects. It has an extensive sale in Tennessee and the adjoining States.

DIXON SPRINGS,

DECATUR COUNTY.

Post-office, Perryville. Access *via* Paducah, Tennessee, and Alabama R. R. to Perryville; thence three miles to springs.

These springs are located in the Tennessee valley, well beyond the line of overflow. There are many attractive features of climate and scenery in this region to attract the tourist or invalid. The springs, however, have been allowed to languish, and there are at this time no accommodations for permanent guests, yet many persons make short visits to the springs during the summer months to avail themselves of the medicinal properties of the water. The principal spring yields about 600 gallons per minute. No complete analysis has been made, but we are informed by Mr. Wallace Dixon, the proprietor, that magnesia is the predominating element. There are three other springs within a radius of twenty or thirty yards, which are said to be respectively limestone, freestone, and chalybeate in character. It is stated that rheumatism and nervous disorders are benefited by the waters here.

FERNVALE SPRINGS,

WILLIAMSON COUNTY.

Post-office, Fernvale Springs. Hotel and cottages. Access *via* Louisville and Nashville R. R. to Franklin; thence thirteen miles west to springs. Or *via* Nashville, Chattanooga, and St. Louis R. R. to Bellview; thence twelve miles southwest to springs. The location is twenty-five miles southwest of Nashville.

This pleasant summer resort has been long and favorably known to the citizens of Nashville and the surrounding country. It has recently been thoroughly renovated, and it is said that guests from as far away as Texas are beginning to find their way to Fernvale. Many attractions are afforded to the visitor in the picturesque hilly and wooded districts surrounding the springs.

The situation of the resort is about 1400 feet above the sea-level.

The springs here are six in number, only three of which are mineralized. An analysis was made in 1836 by G. Troost, analytical chemist, and in 1879 by Prof. N. T. Lupton, of the Vanderbilt University. The former analysis is antiquated and incomplete. We present Lupton's analysis:

FERNVALE SPRINGS.

Alkaline-saline. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	1.14
Sodium sulphate	13.76
Sodium sulphide	8.30

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	8.85
Lithium carbonate	Trace.
Calcium sulphate	27.63
Calcium carbonate	7.04
Magnesium carbonate	6.52
Iron oxide and alumina	0.55
Silica	0.05
Total	73.84

Sulphureted hydrogen gas, 14.21 cubic inches.

This water is very clear and not unpleasant to the taste. It has been very efficacious in skin affections of the squamous variety and in disorders of the alimentary tract and kidneys. It is also used locally in the treatment of sore eyes, chafing of the skin, superficial ulcerations, etc.

GALBRAITH SPRINGS,

HAWKINS COUNTY.

Post-office, Galbraith Springs. Hotel and cottages. Access *via* Southern R. R. (formerly East Tennessee, Virginia, and Georgia) to Russellville, Hamblen County; thence nine miles north by private conveyance to springs.

For the last half century these springs have been known and resorted to by the inhabitants of the surrounding districts. In antebellum days they were frequented by hundreds, who made their temporary abodes in pole cabins around the springs. The location is in a broken, mountainous country, 1400 feet above the sea-level. The immediate surroundings of the springs are uniquely charming in their wealth of vale and wood, brooks, rivulets, and waterfalls, and other features to please the fancy. The situation of the springs is one mile distant from the Holston River, in a romantic glen, 330 feet above the base of Short Mountain. A path leads to the United States Signal Station on the top of Short Mountain, which is 1302 feet above the springs and 2702 feet above the sea-level. From this point one of the most extended and charming views to be found among the mountains of East Tennessee is revealed to the eye. The hotel is a very comfortable establishment, where the visitor will soon learn that all the needful arrangements for his comfort and diversion are at hand. Among the amusements at Galbraith Springs may be mentioned bowling, dancing, and music. Hunting and fishing may also be indulged in. The springs are four in number. An analysis was made in 1884 by Prof. W. A. Noyes, of the University of Tennessee, with the following results:

GALBRAITH SPRINGS.

Light Calcic-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	3.84
Calcium sulphate	0.92
Calcium nitrate	Trace.
Calcium phosphate	"
Magnesium carbonate	0.47
Lithium carbonate	Trace.
Sodium sulphate	0.26
Sodium chloride	0.07
Potassium sulphate	0.16
Iron carbonate	0.41
Alumina	0.03
Silica	0.68
Total	6.84

Temperature of water, 55° F.

This analysis shows a very light mineralization, yet the water seems to possess considerable merit as a ferruginous tonic, and can be taken in large quantities. It is also an excellent table water.

GLEN-ALPINE SPRINGS,

SEVIER COUNTY.

Post-office, Newport, Cocke County. Hotel. Access *via* Southern R. R. to Newport, Cocke County; thence by stage twelve miles west to springs.

These springs are located in a mountainous region, 3000 feet above the sea-level. The usual charming scenery and exhilarating climate of the East Tennessee mountain district will be found here. The springs are four in number, and yield about 60 gallons each per hour. No analysis has been made, but the water is said to be chalybeate and very serviceable in debilitated and anæmic states, especially those arising from disorders of digestion and assimilation. Hay-fever patients are said to improve rapidly by a sojourn at these springs. The improvements at the resort are by no means elaborate at present, but the location offers many attractions during the summer months to persons not afraid to grow strong by roughing it.

GLENN SPRING,

TIPTON COUNTY.

Post-office, Atoka. Cottages. Access *via* Chesapeake, Ohio, and Southwestern R. R. (Mississippi Valley route) to Atoka; thence seven miles to springs.

This spring is situated under the shadow of the Chickasaw Hills.

It has quite an ancient reputation in Western Tennessee in the treatment of liver, kidney, and digestive disturbances.

The spring is surrounded by a magnificent grove of trees, which lends a romantic charm to the neighborhood. It yields about 90 gallons of water per hour. The following analysis was made in 1880 by W. T. Lupton, analytical chemist:

GLENN SPRING.

Alkaline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	1.58
Calcium carbonate	9.64
Magnesium carbonate	7.10
Potassium carbonate	0.05
Iron carbonate	0.54
Potassium sulphate	0.27
Calcium phosphate	0.01
Sodium chloride	0.16
Silica	1.38
Total	20.73

Carbonic acid gas, 14.64 cubic inches.

This is a very good antacid and mild diuretic water, with ferruginous properties.

HINSON'S SPRINGS,

Henderson County.

Post-office, Hinson Springs. Hotel and cottages. These springs are located twenty-four miles east of Jackson, on the line of the Tennessee Midland R. R.

The location is in a picturesque, hilly region, quite elevated. A large and beautiful park surrounds the springs. The hotel buildings are all new, and are furnished with the latest appliances and conveniences. The springs are five in number—two chalybeate, two sulphur, and a freestone or pure spring. Mr. J. H. Long, the proprietor, informs us that no analysis has been made so far. The waters are said to have excellent table qualities, and they have also been recommended in anæmic states, phthisis, dyspepsia, and rheumatism.

HORN'S SPRINGS,

Wilson County.

Post-office, Lebanon. Hotel. Access *via* Nashville, Chattanooga, and St. Louis, or Nashville and Knoxville R. R., to Lebanon, thirty miles northeast of Nashville; thence five miles west to springs. Conveyances meet all trains.

The location of Horn's Springs is somewhat elevated and characterized during the summer months by refreshing breezes. A comfortable new hotel has recently been built, and is kept open all the year round. The springs are eight in number. According to an analysis made by Profs. Safford and Summers, of Vanderbilt University, one of the springs contains the following chemical ingredients:

Calcium carbonate.
Magnesium carbonate.
Iron carbonate.
Potassium carbonate.
Sodium sulphate.
Magnesium sulphate.
Calcium sulphate.
Sodium chloride.
Phosphoric acid.
Silicic acid.
Carbonic acid.
Sulphureted hydrogen.
Organic matter (trace).

This may be taken as a type of all the springs, which, we are informed, contain much iron and have decidedly purgative effects, resembling to some extent the water of the Crab Orchard Springs of Kentucky. The waters of Horn's Springs have an extensive reputation in Tennessee, and the contents show that they may be useful in conditions of the system requiring an alkaline regimen, a ferruginous tonic, or a mildly stimulating cathartic.

HOWARD SPRINGS,

Cumberland County.

Post-office, Crossville. Boarding-house. These springs are located on a moderately rolling plateau, three and one-third miles west of Crossville. The elevation is 1900 feet above the sea-level, and many fine views are to be had in the neighborhood. There is one large spring, and three small ones, the latter being unimportant. The large spring flows about 600 gallons per hour. No complete analysis has been made, but we learn that the water is strongly chalybeate and also contains sulphur and magnesia. It is efficacious in anæmic states, and in liver, stomach, and renal disorders. The water is said to be a great appetizer.

LINE SPRING,

Sevier County.

Post-office, Line Spring. Cottages. This resort is located in a mountainous region thirty miles east of Knoxville, at an elevation of 2600 feet above tide-water. The usual fine scenery and delightful climate of the East Tennessee Mountains will be found here. It is said that the proportion of pleasant days to disagreeable ones is as 10 to 1. Owing to the existence of a constant breeze at night, it is stated that dews are unknown. The waters of the spring are chalybeate in character, and useful in conditions where iron is indicated.

MELROSE SPRING,

BLOUNT COUNTY.

Post-office, Maryville. Hotel (seventy-five guests). Access from Knoxville *via* Southern R. R. (Knoxville and Augusta branch) to Maryville; thence eight miles by stage to springs.

This resort is located among the picturesque mountains, at an elevation of 1500 feet above the sea-level. It is kept open from May 15th to the end of October. The springs are four in number, No. 1 being known as the "Chalybeate," and No. 2 as the "Yellow Sulphur," while the last two are freestone springs, with no special medicinal properties. No analysis has been made, but the chalybeate water is said to be one of the best and strongest in the State. In addition to its internal use, it is used locally for its astringent effects.

MINERAL HILL SPRINGS,

GRAINGER COUNTY.

Post-office, Bean's Station. Hotel and sanitarium. These springs are located in the Bean's Station Valley, near the foot of Clinch Mountain, ten miles from Morristown. The peculiar arrangements of the valleys, hills, and mountains gives rise to a cool, refreshing air-current, always passing from north to south in the morning, and from south to north in the afternoon. We are informed by Dr. W. J. Heacker, of Bean's Station, that as many as twelve varieties of mineral water are found near the hotel, among which are mentioned red, white, and black sulphur, chalybeate, Epsom and alum waters. No analyses appear to have been made. The accommodations of this resort appear to have been largely extended and improved. It is stated that many varieties of ills are benefited by the genial climate and a free use of the waters.

MONTVALE SPRINGS,

BLOUNT COUNTY.

Post-office, Montvale. Hotel and cottages. Access from Knoxville *via* Knoxville and Augusta R. R. to Maryville, the present terminus of the line; thence by stage line to springs. The springs are twenty-five miles south of Knoxville.

This resort is located at the foot of the Chilhowee Mountains, 1300 feet above the sea-level. The springs have been celebrated in East Tennessee for a period of fifty years or more, and long before the Civil War the location was a fashionable summer resort, where people of this and other States found health and pleasure during the heated term. From year to year extensive improvements have been made, and now we find among the picturesque mountains a watering-place supplying about everything which goes to make up a healthful and agreeable refuge from the summer heat of the semi-tropical Southern States. The big hotel building, with its seven gables, is located in a romantic spot, and around it cluster forty neat cottages, giving the place the appearance of a charming little village built among the forest trees. Walks, fountains, beautiful brooks, and flowers are found on every side, and with the evergreen mountains for a background, form a picture of great loveliness. Fronting the hotel is a large park, with broad, smooth drives and walks, and grassy lawns, affording ample scope for outdoor diversions. Fountains, swings, hammocks, and rustic retreats are scattered here and there. The hotel is supplied by a system of water-works from the "Sweet William" Spring. The medicinal springs are the "Great Chalybeate" Spring, nearest the hotel, and the "Black Sulphur" Spring, on the road near Montvale. The following analysis of the Chalybeate Spring was made by Prof. S. B. Mitchell :

MONTVALE SPRINGS.

Sulphated-saline-chalybeate.

One U. S. gallon contains :

Solids.	Grains.
Calcium carbonate	13.26
Iron carbonate	2.40
Sodium sulphate	4.51
Calcium sulphate	74.21
Magnesium sulphate	12.00
Sodium chloride	1.96
Aluminium oxide	0.50
Total	108.84

In addition to its ferruginous tonic effects this water also acts as a saline aperient. It has long been recommended as a safe and reliable remedy for many of the protean ills included under the name of dyspepsia. It is also valuable in uric-acid states, especially in those characterized by genito-urinary manifestations. The Black Sulphur Spring contains 109.30 grains of solids to the United States gallon, of which the sulphate of magnesia (grains 17.07), and the oxide of iron (grains 1.19) are the most important.

OLIVER SPRINGS,

ANDERSON COUNTY.

Post-office, Oliver Springs. Hotel. Access from Knoxville *via* Southern R. R. (formerly East Tennessee, Virginia and Georgia R.R.), thirty-five miles northwest to springs.

The Oliver Springs and the small village of the same name are situated on the southern slope of the Cumberland range of mountains, where the counties of Anderson, Roane, and Morgan join their boundary lines. The surroundings of the resort are very pleasing, and the climate of a genial, attractive character. The average summer temperature at the springs is 72° F., and of the winter 38° F., showing an unusually low variation. It is said that malaria has never been known to exist in the vicinity. There are nine mineral springs within the ten acres occupied by the hotel grounds. They have not been fully analyzed, but are said to contain iron, manganese, lithia, magnesia, and sulphur. They are used considerably for medicinal purposes, and, joined with the beautiful scenery, the pleasant climate, and a comfortable, new hotel, they serve to render this location a very attractive one for the health or recreation seeker.

RED BOILING SPRINGS,

MACON COUNTY.

Post-office, Red Boiling Springs. Hotel. Access *via* Louisville and Nashville R. R. to Gallatin; thence by private conveyance to the springs.

This resort is located in the foothills of the Cumberland Mountains, sixty-five miles northeast of Nashville and seven miles from the Kentucky line. It has an elevation of about 1200 feet above the sea-level. The visitor will at this resort find a cool and pleasant retreat for the summer months. All the customary diversions for beguiling vacation hours are supplied by the management. The hotel is said to be well kept and comfortable, and the cuisine of an excellent character. There are three springs in the group—two red sulphur springs and one black sulphur spring. Those most generally used are the "Little Red" and the "Black Sulphur" Springs. The former was analyzed by Lucius Pitkin, analytical and consulting chemist, of New York City, in 1890, with the following results :

LITTLE RED SPRING.

Alkaline-saline. Sulphureted.

One U. S. gallon contains :

Solids.	Grains.
Sodium chloride	5.57
Sodium sulphate	0.94
Calcium sulphate	8.18
Potassium sulphate	0.41
Calcium bicarbonate	3.20
Magnesium bicarbonate	4.55
Iron bicarbonate	0.15
Silica	0.80
Total	23.80

Sulphureted hydrogen gas, large quantities.

The following analysis of Red Spring No. 2 was made by James T. Anderson, of the Alabama State Agricultural and Mechanical College at Auburn :

RED SPRING NO. 2.

Saline-calcic. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	10.73
Sodium carbonate	1.03
Calcium carbonate	9.64
Calcium sulphate	15.36
Magnesium sulphate	7.97
Alumina	0.12
Iron oxide	0.08
Silica	0.58
Organic and volatile matter	2.31
Total	47.82

Sulphureted hydrogen gas, 0.27.

The temperatures of the waters are 54° and 52° F., respectively, and do not vary during the year. They are said to be actively diuretic and to exert a general tonic and alterative effect upon the system. Hot and cold sulphur baths may also be had at all hours. A competent physician is always at hand to explain the proper use of the waters.

ROBINSON SPRING,

VAN BUREN COUNTY.

Post-office, Chalybeate. Cottages. Access *via* Nashville, Chattanooga and St. Louis R. R. to McMinnville; thence sixteen miles by private conveyance to springs. We are informed that a railroad route has recently been surveyed, passing within a distance of one and one-half miles of the springs.

This resort seems to possess a number of attractive features, but it is at the present time somewhat cramped for proper accommodations for the increasing number of visitors. It is believed that the new railroad will give a great impetus to the development of the place. The water was analyzed by Dr. Black, of McMinnville, several years ago, but no copy of the results obtained have been preserved. It is recommended for constipation, dyspepsia, anæmia, dysmenorrhœa, amenorrhœa, and general debility. The resort has an elevation of 1750 feet above the sea-level.

SOUTH SARATOGA SPRINGS,

BLEDSOE COUNTY.

Post-office, Pikeville. Hotel and cottages. This resort is located on a plateau of the Cumberland Mountains, ten miles west of Pikeville, the present terminus of the Sequachee Valley R. R. It is reached from Pikeville by stage or horseback. The roads are good and the wayside scenery very fine. The springs are delightfully situated in a grove of maple and oaks. The high elevation—1800 feet above the sea-level—insures cool and breezy summers, with freedom from insects and malaria. The springs are two in number. The waters have not been analyzed, but they are said to be chalybeate and freestone. Liver and kidney disorders are benefited by their use.

TATE SPRING,

GRAINGER COUNTY.

Post-office, Tate Spring. Hotels and cottages. Access *via* Morristown and Cumberland Gap R. R. to Morristown; thence ten miles by carriage to springs.

This resort is 1400 feet above the sea-level, and is located in a charming valley environed by mountains 3000 feet in height. It may be regarded as one of the strictly first-class summering places of the Tennessee Mountains. The beautiful and picturesque scenery and genial climate are supplemented by the addition of two excellent modern hotels and numerous cottages. There is but one spring, which yields 120 gallons per hour. The following analysis was made in 1872 by T. S. Antisell, Professor of Chemistry in the National Medical College and chemist to the United States Department of Agriculture:

TATE SPRING.

Saline-calcic. Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	160.66
Magnesium sulphate	32.91
Sodium sulphate	8.50
Potassium sulphate	1.54
Sodium chloride	40.27
Iron chloride	2.99
Magnesium chloride	0.62
Sodium iodide	Traces.
Calcium phosphate	1.14
Calcium carbonate	21.56
Silica	2.70
Nitric acid	0.02
Total	272.91

The analysis shows a saline purgative water, with tonic and alterative properties. It has been found beneficial in functional disorders of the nervous system induced by overwork and mental worry, in cases of hypochondria and insomnia, and in chronic metallic poisoning. Some forms of dyspepsia and liver disorders are also improved by its use.

The water is now used commercially, and shipped by the bottle, case, or barrel to any desired point.

UNAKA SPRINGS,

UNICOI COUNTY.

Post-office, Unaka Springs. Hotel. Access *via* Southern R. R. to Johnson City; thence *via* Ohio River and Charleston R. R. (Tennessee division), twenty-three miles to Unaka Springs. The location is seventeen miles from Jonesboro.

This resort is pleasantly located in a small cove, containing eight or ten acres, at the foot of the Unaka Mountains. The location is about 2000 feet above the sea-level, and is entirely surrounded by higher elevations. The springs are four in number, and flow about 9000 gallons per hour. No analysis has been made. The waters are said to contain iron and sulphate of magnesia. They are recommended for indigestion, chronic dysentery, and other diseases.

UPPER RED BOILING SPRINGS,[1]

MACON COUNTY.

Post-office, Red Boiling Springs. Hotel. Access *via* Nashville and Chattanooga R. R. to Carthage; thence twenty-five miles by stage to springs. Or *via* Louisville and Nashville R. R. to Gallatin; thence forty-five miles by stage. Or *via* Middle and East Tennessee Central R. R. to Hartsville; thence twenty-eight miles by stage.

This resort was formerly known as Whitley Springs, and for many years its waters have had a wide reputation in this section. They are located on the highland rim in the eastern part of Macon County—a region well known for its fine climate and beautiful scenery. The Red Spring throws up a large amount of gas, which gives it the appearance of boiling. It deposits a brilliant red sediment, which covers the sides and bottom of its basin and imparts a reddish tinge to the water. The Black Spring also possesses this peculiar boiling characteristic.

The Red Spring was analyzed by Messrs. J. M. Safford and J. C. Wharton in 1893, with the following results:

UPPER RED BOILING SPRING.

Muriated-calcic. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	31.16
Calcium carbonate	7.03
Magnesium carbonate	5.75
Sodium chloride	43.87
Potassium chloride	0.44
Aluminium sulphate	0.15
Iron carbonate	0.10
Silica	0.47
Organic matter and loss	2.42
Total	91.39

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[1] No connection with Red Boiling Springs, p. 443.

Gases.	Cubic inches.
Sulphureted hydrogen Carbonic acid	9.95

The waters of the Red Spring are highly recommended in renal and bladder affections, especially those arising from the uric acid or lithæmic tendency. They are believed to possess a powerful solvent action on renal calculi and gravel stones. These waters are also said to be of great value in cases of chronic uterine inflammations, leucorrhœa, etc. The Black Spring water has an excellent reputation in the treatment of rheumatism. The waters of both springs possess tonic and appetizing qualities. A comfortable hotel, with modern conveniences and abundant bathing facilities, was built in 1890. There are also a number of private boarding-houses in the vicinity.

WRIGHT'S EPSOM LITHIA WELL,

HAWKINS COUNTY.

This well is located near Mooresburg, five miles from Galbraith Springs. It contains 157.47 grains of sulphate of magnesia per United States gallon, and is prized as a quick, safe, and pleasant laxative. The water is kept on draught at Galbraith Springs for the free use of vistiors.

There are a considerable number of mineral springs and artesian wells in Tennessee, reported in the geological works, whose present status we have not been able to ascertain. Among them are the following, which, it is said, are, or have been, used as resorts:

Alleghany Springs, fourteen miles south of Maryville, Blount County; chalybeate and sulphureted.

Beaver Dam Springs, in the southern part of Hickman County; sulphureted.

Bon Aqua Springs, seven miles south of Burns, Hickman County; calcic, sulphureted.

Canwood's Springs, near Dandridge, Jefferson County; chalybeate, sulphureted.

Cascade Springs, near Tullahoma, Franklin County; alkaline and sulphureted.

Draper's Springs, Bloomington, Putnam County; chalybeate and sulphureted.

Eldorado Springs, Chancy, Robertson County; sulphureted.

Elkmont Springs, Elkton, Giles County; chalybeate.

Estill Springs, Estill Springs, Franklin County; alkaline, chalybeate, and sulphureted.

Gibson Wells, nine miles southwest of Trenton, Gibson County.

Glover's Springs, near Union Depot, Sullivan County; chalybeate.

Graham's Springs, near Rebecca, Franklin County; calcic, alkaline, and sulphureted.

Hurricane Springs, near Tullahoma, Franklin County; alkaline and sulphureted.

Idaho Springs, Saint Bethlehem, near Clarksville, Montgomery County.

Kingston Springs, Kingston Springs, Cheatham County; sulphureted and chalybeate.

McEwen's Springs, Franklin, Williamson County.

Mooresburg Springs, near Mooresburg, Hawkins County; chalybeate.

Nashville Sulphur Spring (artesian), Nashville, Davidson County; saline, sulphureted.

Patterson's Springs, near Birdsville, Cocke County.

Pickwick White and Red Sulphur Springs, near Walnut Grove, Hardin County.

Rhea Springs, Rhea Springs, Rhea County; alkaline, saline, chalybeate.

Wayland's Springs, Wayland's Springs, Lawrence County; saline. chalybeate.

Wood's Springs, near Miles Cross-roads, Clay County.

TEXAS.

Texas extends from 25° 51′ to 36° 30′ north latitude, and from 93° 31′ to 10° 43′ west longitude. The surface features of the State are exceedingly varied, the prevailing elements being steppes or treeless plains in the northwest, mountains west of the Pecos River, forests in the east, marshes adjacent to the coast, low prairies in the southeast, and a combination of prairies and broken hills, interspersed with forest growth and thickets of tall shrubs (chaparral), in the centre. Some of the mountain peaks between the Pecos and Rio Grande reach a height of from 4000 to 9000 feet. The chief rivers of the State are the Sabine and the Neches, flowing into Sabine Lake; the Trinity, Brazos, Guadaloupe, Nueces, Pecos, Colorado, and Rio Grande del Norte. The seacoast of the State is about three hundred and fifty miles in length, and indented with several bays, besides the mouths of the rivers. The State presents many varieties of climate and temperature. In the winter snow falls and ice is formed in the northern part, while in the south frosts are unknown and the climate is almost tropical. A prominent climatological feature of the State is the occurrence during the autumn and winter months of high winds from the north or northwest, hence called "northers," which sweep the State and pass far out into the Gulf of Mexico, offering a considerable menace to navigation. These winds are accompanied by a remarkable fall in the temperature. The climate of the State on the whole, however, is exceedingly salubrious and highly conducive to a vigorous animal and vegetable life. The mean annual temperature of Texas is 56° F. in the far north, 66.72° F. at Austin, and 75° F. in the extreme south. The average annual rainfall is 41 inches. The rate of mortality, as computed from the United States census for 1890, was 11.84 per 1000 of population. The phthisical death-rate was 0.92 per 1000 of population.

Previous works on mineral springs credit Texas with but few localities. Pepper's list mentions five and Walton's book three. The National Geological Reports, however, give the names and locations of about one hundred different mineral spring localities. These may be divided into undeveloped springs, which constitute the large majority; abandoned springs, of which there are several in the State; mineral spring resorts, about twenty in number, and commercial springs, of which ten reported sales of water in 1895. The State stood No. 5 in the amount of mineral spring water sold in the markets during that year.[1] Sulphureted springs predominate, although there are many chalybeate and a few alum and acid springs. But few analyses have been made.

BURDETT MINERAL WELLS,

Caldwell County.

Post-office, Luling. Hotel. Access *via* San Antonio and Aransas Pass R. R. to Burdett Switch, where carriages meet trains for the springs during the summer season. The location is seven miles north of Luling, on the Galveston, Harrisburg and San Antonio R. R.

Only one well is in use. The water has been employed for medicinal purposes for thirty years. According to a qualitative analysis made in 1877 by H. W. Johnson, of Boston, Mass., it contains the following acids and bases:

Acids.	Bases.
Sulphuric acid.	Calcium.
Carbonic acid.	Magnesium.
Silicic acid.	Aluminium.
Hydrochloric acid.	Manganese.
Boric acid.	Strontium.
Phosphoric acid.	Iron.
	Potassium.
	Sodium.

CAPP'S MINERAL WELLS,

Gregg County.

Post-office, Longview. Hotels and boarding-houses. Access *via* International and Great Northern or Texas and Pacific R. R. to Longview.

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[1] United States Geological Report for 1895–1896.

These wells, two in number, are situated in Longview, being on a slight eminence about 75 feet above the general level of the city. The country about Longview is somewhat undulating in character. The weather is very warm during the summer months, but is tempered by cooling breezes. The climate, on the whole, is quite healthful. The town is abundantly supplied with hotels and boarding-houses. A partial analysis of the water of Capp's Wells, made in 1886 by Edgar Richards, assistant chemist of the United States Department of Agriculture, Washington, D. C., showed the presence of 264.76 grains of solid matter to the United States gallon of 231 cubic inches. The water evidently belongs to the sulphureted group, and contains large amounts of the sulphate of iron and magnesium, chlorides of calcium and magnesium, besides much sodium and potassium salts. There is sufficient sulphate of magnesium present to make the water a strong purgative. It is used commercially, and shipped in five- and ten-gallon kegs to any desired point. It has been found useful in a number of diseased conditions and will preserve its purity after months of standing. These are combined chiefly in the form of sulphates, chlorides, and carbonates. The water is said to possess the virtues of the German bitter waters and to be useful in the class of cases to which those waters are applicable.

GIBSON WELLS,

PALO PINTO COUNTY.

Post-office, Mineral Wells. Hotels and boarding-houses. Access: From Weathersford on the Texas, Pacific and Santa Fé R. R. *via* the Weathersford, Mineral Wells and Northwestern R. R.

The location of this resort is in a valley about 1500 feet above the sea-level. It is surrounded on two sides by rocky hills rising to the height of 250 feet. There are about fifty or sixty wells in the vicinity, from 120 to 200 feet in depth and yielding from 60 to 600 gallons of water each per day. The temperature of the water is about 72° F., some of the wells being a trifle warmer. The following analysis of the Gibson Well was made by E. T. Dunn, State Geologist:

GIBSON MINERAL WELL.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	20.08
Sodium sulphate	256.60
Sodium carbonate	29.06
Calcium carbonate	15.66
Magnesium carbonate	6.19
Iron and alumina	0.87
Silica	1.19
Total	329.65

Carbonic acid gas, 4.62 cubic inches.

The water is used commercially, and various preparations are also manufactured from the evaporated residue and sold. The Gibson Well condensed water, each gallon representing the strength of 40 gallons as it comes from the well, is said to be an excellent saline cathartic, its operation being unattended by griping or discomfort.

INDIAN MINERAL SPRINGS,

Kendall County.

Post-office, Boerne. Boarding-houses. The town of Boerne is located about thirty miles northwest of the city of San Antonio, on the line of the San Antonio and Aransas Pass R. R. The country has a general elevation of about 1670 feet above the sea. The general aspect of the country is very pleasing, being quite hilly, even rugged in places. There are many beautiful drives and fine views. The town of Boerne has a population of about 800.

It contains a telegraph and express office, very good hotels and boarding-houses. Four trains daily reach the place. From data furnished by the National Climatologial Reports it is found that the average number of sunny days in each year is 277, and that invalids can enjoy more or less outdoor life 350 days yearly. The average summer temperature of the place is 85° F.; winter temperature 62° F. It is said that a cooling southeast breeze from the gulf prevails all the year and greatly tempers the heat of the summer sun, making the evenings and nights cool and pleasant. The location is beginning to attract the attention of Northern visitors, who visit the place in constantly increasing numbers during the winter months. The Indian Mineral Spring is located three miles from Boerne, from which it is reached by stage and private conveyances. The water is said to be efficacious in a variety of debilitated states, besides being a valuable table water. A partial examination was made by Prof. Charles F. Chandler, of New York. It showed the presence of 138.38 grains of solids per United States gallon, consisting principally of calcium, magnesium, and sulphuric acid in the form of sulphates. A more detailed analysis will be required to classify the water properly.

OVERALL MINERAL WELLS,

Robertson County.

Post-office, Franklin. Hotels. Access *via* International and Great Northern R. R.

Franklin, the county-seat of Robertson County, is pleasantly situated in a fertile, somewhat undulating farming country, twenty miles east of the Brazos River and 600 feet above the level of the sea. It is a busy and growing town, with several good churches and excellent public free schools. The climate here is mild and salubrious, the heat of summer being tempered by the breezes which flow in from the gulf. The winters are mild and agreeable. The place is well supplied with hotels and boarding-houses. The mineral wells of Franklin are two in number. Analysis by Prof. Edgar Everhart, of the University of Texas, shows the following result:

OVERALL MINERAL WELLS.

Sulphated-saline. Aluminous and Chalybeate.

One U. S. gallon contains: Solids.	Well No. 1. Grains.	Well No. 2. Grains.
Sodium chloride	9.72	9.05
Sodium sulphate	7.11	14.12
Potassium sulphate	0.75	2.56
Aluminium sulphate	81.71	4.99
Iron sulphate (sulphate of protoxide in No. 1)	75.95	144.90
Calcium sulphate	20.96	37.09
Magnesium sulphate	13.06	20.03
Ammonium sulphate	Trace.	. . .
Silica	2.04	2.24
Organic and volatile matter	2.45	. . .
Total	213.75	234.98

These are exceedingly strong chalybeate waters. They probably contain some free acid, as they show an acid reaction. No. 1 is very rich in alum. Both waters are quite strongly astringent. They are used commercially, and to save expense of shipment are condensed. The waters have a valuable influence, when taken internally, in cases of diarrhœa and dysentery, which are frequent in the South. They are also valuable in catarrhal affections of the liver and in debilitated conditions. Locally they are used in the form of a lotion, gargle, spray, or douche, as the occasion and the part affected may require.

RED SPRINGS,

Bowie County.

Post office, Park. These springs are located ten miles west of Texarkana and two miles south of the line of the Transcontinental R. R. Passengers get on or off trains at a flag station.

Although classed as a resort by the Geological Reports, we are informed by Mr. David Jarrett, the son of the proprietor, that no improvements have ever been made. There are two red and one yellow spring. The ingredients of the water are unknown, but it is said to be actively diuretic. It is said that their medicinal qualities have been known for more than fifty years. The location offers many advantages, and it is believed that a fine summer resort will ultimately be established here.

SPRINGS OF SAN SABA COUNTY.

We are informed by Dr. N. Ketchum, of San Saba, that mineral springs of undoubted remedial value are very abundant in San Saba County. No analyses have yet been made, but many of the springs contain iron and sulphur. This region is blessed by a very genial and salutary climate. The aspect of the country is hilly, with rich prairie valleys intervening. Heavy forests of valuable timber abound. The country is new and undeveloped, but the mineral waters are beginning to attract much attention.

SULPHUR SPRINGS,

Hopkins County.

Post-office, Sulphur Springs. Hotels and boarding-houses. Access *via* Missouri, Kansas and Texas, or *via* the Cotton Belt R. R., direct to springs.

This resort is located in Sulphur Springs, a town of 4500 inhabitants. The location is about 400 feet above the level of the Mexican Gulf and about three hundred miles from the coast. The springs may be visited all the year round, as the winters are mild and the summers are tempered by cooling breezes. The waters have not been analyzed, but they are believed by the local physicians to contain calcium, sulphur, iron, aluminium, a trace of iodine, and nitric and sulphuric acids. The springs yield an abundance of water for all desired purposes. It has a pleasing, somewhat acidulous taste, and is said to be very efficacious in the treatment of dyspepsia and indigestion. An ointment prepared from the evaporated residue has a great local reputation in the treatment of hemorrhoids, indolent ulcers, eczema, etc.

SUTHERLAND SPRINGS,

Wilson County.

Post-office, Sutherland Springs. Hotel and boarding-houses. Access: From San Antonio *via* the San Antonio and Gulf R. R., thirty miles distant.

This resort is pleasantly located on the Rio Cibolo, at an elevation of about 400 feet above the sea-level. The surrounding country is of a gently undulating character, and presents much pleasing scenery of a mild and tranquil character. This part of the State is celebrated for its genial climate and its freedom from malarial and miasmatic disorders. At the date of our correspondent's letter, December 27th, the flowers were in full bloom out of doors and the gardens were as green as in summer. There is no ice at any time, and the frosts are seldom sufficiently severe as to cause the trees to shed their leaves. Many persons who begin the baths during the summer continue them during the winter months, as it is seldom cold enough to interfere with this pastime. No analysis of the water has been made, but the numerous springs are said to offer a number of therapeutic properties—tonic, alterative, astringent, laxative, diuretic, etc. This combination of valuable spring waters with a mild, dry, equable climate makes the location a very attractive one for a large class of sufferers from various ailments. It is said that a fine modern hotel will soon be built.

TEXAS SOUR SPRINGS,

(*Known also as Caldwell Springs.*)

CALDWELL COUNTY.

Post-office, Luling. Hotel. Access *via* Galveston, Harrisburg and San Antonio R. R. to Luling; thence six miles north to springs. The location may also be reached by way of the Burdett Mineral Wells, which are not far distant (q. v.).

This is quite a new resort, although the existence of the springs has been known since the early settlement of the country. Tradition has it that the aborigines employed the waters for medicinal purposes, and that Colonel Davy Crockett bathed his wounds in their cool and limpid flow after his famous single-handed fight with the Mexican lions in this vicinity. The springs are located in a rolling country, at an elevation of 700 feet above the sea. The air here is dry and balmy, the winters being mild and the summers breezy and pleasant. It is stated that malaria never develops in the neighborhood. The springs are five in number, and afford about 60 gallons of water per hour. They differ but little in their chemical constitution. The following analysis was made by Prof. H. H. Dinwiddie, of the Texas Agricultural and Mechanical College.

TEXAS SOUR SPRINGS.

Sulphated-saline. Acid-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Aluminium and potassium sulphate	100.08
Ferrous sulphate	7.58
Magnesium sulphate	16.17
Sodium chloride	42.74
Calcium sulphate	125.01
Magnesium chloride	132.84
Lithium chloride	Traces.
Free sulphuric acid	7.26
Soluble silicates	12.18
Organic matter and loss	5.12
Total	448.98

This analysis shows a rich and potent mineral water. It is a well-marked example of the acid-saline-chalybeate class, and exerts a marked influence when taken internally. It possesses cathartic, alterative, diuretic, and tonic properties. Locally it is astringent, and is beneficial as a lotion in conjunctivitis, a gargle in pharyngitis, a douche in leucorrhœa, etc. The water is used commercially, and an extract prepared from the dried residue is also found in the markets under the name of the "Texas Sour Mass." It is said to possess all the virtues of the water.

WOOTAN WELLS,

ROBERTSON COUNTY.

Post-office, Wootan Wells. Hotel and cottages. Access *via* Houston and Texas Central R. R. to Wootan Junction; thence two miles to springs. Street-cars meet all trains, day and night, from about April 1st to November 1st. During the winter months only day trains. The location is one hundred and forty-five miles north of Houston and one hundred and twenty-five miles south of Dallas.

These wells are located on a picturesque eminence about 500 feet above the level of the gulf. The first well was dug in 1877 by Mr. F. M. Wootan, an immigrant from Alabama. The water was found to be unfit for cooking or washing purposes, so Mr. Wootan rented the farm on which the well was situated to a neighbor, whose health was bad and who also had a puny wife and children. They found it necessary to use the "bad" water for drinking purposes, and the sickly family all got well and remained well. This was the beginning of a health resort which has now become widely and favorably known. Persons with means became interested. More wells were dug, and at this time about all the attractions of any first-class interior watering-place will be found here. These include a large, well-arranged brick hotel, with abundant bathing facilities; an opera house, archery court, croquet grounds, beautiful groves, camp grounds, etc. The place is naturally well adapted for good drainage, and no pains are spared by the management to keep the surroundings in a sanitary condition. The resort is open the year round. Analyses of the different wells show very little difference in their chemical ingredients. Following are specimen analyses of two of the wells, the first by Prof. Charles F. Chandler, of New York, and the second by Dr. W. M. Mew, chemist of the United States Naval Department, Washington, D. C.:

WELL NO. 1.

Sulphated-saline. Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Chlorine in chlorides	23.34
Magnesium	13.11
Calcium	25.21
Iron protoxide	1.20
Iron sesquioxide	0.69
Aluminium sesquioxide	1.22

One U. S. gallon contains:

Solids.	Grains.
Manganese oxide	0.54
Sulphuric acid in sulphates	59.67
Silica	3.28
Organic and volatile matter	9.62
Total	137.88

WELL NO. 4.

Sulphated-saline. Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Chlorine in chlorides	36.36
Magnesium	22.75
Calcium	28.18
Iron sesquioxide	13.06
Aluminium sesquioxide	3.45
Manganese oxide	0.57
Sulphuric acid in sulphates	86.41
Sodium	18.10
Silica	4.69
Total	213.57

These waters show about the same general chacteristics, No. 4 being somewhat richer in mineral ingredients, especially in iron, than No. 1. It will be observed that the chemists have not worked out in full the combinations of the various elements present. There can be no doubt, however, that the most important compounds contained in the waters are the sulphates of magnesia and soda, and probably the sulphate of iron. These ingredients should impart in the proportions here probably present mild cathartic properties, and, in No. 4 especially, the effects of a strong ferruginous tonic and blood restorer. The waters are highly prized by Texas physicians in the treatment of the various forms of nephritis and in diabetes and rheumatism. They are of undoubted efficacy in some cases of dyspepsia and in catarrhal jaundice and other disorders of the liver and alimentary tract.

The water is used commercially, and is shipped to various parts of the United States.

The following springs are also used to some extent as resorts:

Bell's Mineral Wells, Blossom Prairie, Lamar County.
Chalybeate Springs, near Winnsborough, Wood County.
Coleman Springs, near Annona, Red River County.
Dalby Springs, Dalby Springs, Bowie County.
Duffau's Sulphur Wells, Duffau's Wells, Erath County.
Gunpowder Springs, near Gilmer, Upshur County.
Hughes Springs, Hughes Springs, Cass County.
Sulphur Springs, at Millican, Brazos County.
Thorp's Springs, Thorp's Spring, Hood County.

The following are commercial springs:

Hynson's Natural Iron Spring, Marshall, Harrison County.

Rosborough Springs, Marshall, Harrison County.

Slack's Wells, Fayette County, near Waelder, Gonzales County.

Tioga Mineral Wells, Grayson County.

Walton's work credits Texas with three localities, as follows:

Fairview Springs, near Kosse, Limestone County; light alkaline-saline.

Piedmont Springs, near Millican, Brazos County.

White Sulphur Springs, Cass County, twelve miles from Belden.

We are informed that the last-named locality is used to some extent as a resort.

UTAH.

The State of Utah extends from 37° to 42° north latitude, and from 109° to 114° west longitude. The surface is greatly diversified, containing high mountains, broad, arid valleys, and desert plateaux. The mean elevation of the State is 6100 feet. The lowest portion, near the southern border, is less than 3000 feet above the sea; but, on the other hand, many mountain summits exceed 13,000 feet in height. Of the principal peaks may be mentioned Mount Nebo, in the Wahsatch range (11,680 feet), and Gilbert's peak, in the Uintah range (13,987 feet). The principal stream of Eastern Utah is the Colorado of the West, formed by the junction of the Green and the Grand Rivers. These rivers receive numerous branches from the Uintah and Wahsatch ranges. In Western Utah the country is very arid, and there are few living streams. The Great Basin, of which this region forms a part, consists of a large number of smaller basins differing greatly in magnitude. In each of these the waters from the surrounding mountains sink or collect in a lake, which, having no outlet, rises or falls with the excess of supply or evaporation. The largest of these is the Great Salt Lake, which stretches along the western base of the Wahsatch mountains. Into this lake are drained the rivers from the western slope, the chief being the Weber, Bear, and Ogden. In former geologic times the Great Salt Lake had an area vastly greater than at present, the well-marked shore-lines upon the surrounding mountains having an altitude nearly 1000 feet higher than the present level of the lakes. Its present dimensions are: Length, ninety miles; breadth, twenty to twenty-five miles. The only other bodies of water of considerable magnitude are the Bear and Utah Lakes, both fresh and both tributary to Great Salt Lake. As in other portions of the Western United States, there is a gradation of the climate with respect to aridity, in accordance with the altitude above the sea. Upon the higher mountains there is a sufficient rainfall for vegetation, but in the low country the precipitation is very slight. The annual rainfall at Salt Lake City, which is very favorably situated in this respect, is about 30 inches. In all other habitable parts of the State it is less, being not greater than 10 inches in the southern and western portions. The temperature also has a wide range in different sections. At Salt Lake the mean annual temperature is about 45° F., being 73.59° F. for the summer and 30.38° F. for the winter months. The climate is liable to very abrupt changes, although in many parts of the State it is exceedingly salubrious. The mortality-rate, according to the United States census of 1890, was 10.19 per 1000 of population. The death-rate from consumption was 0.30 per 1000 of population—a remarkably low percentage.

Utah does not occupy a prominent position as a mineral spring State in previous works. Walton mentions but one locality—the Salt Lake Hot Springs. Peale's list in the United States Geological Reports gives the names of about fifty localities, of which it is stated that only six are used as resorts. By dint of a very careful recent inquiry we have obtained information of eight groups of springs which are resorted to more or less for medicinal purposes. Most of these are thermal in character, and their high temperature, great volume, and favorable location will doubtless bring some of them into considerable prominence in the near future. There are numerous mineral springs in unfrequented parts of the State which have never yet received names.

BECK'S HOT SULPHUR SPRINGS,

SALT LAKE COUNTY.

Post-office, Salt Lake City. Hotel. This is a well-known pleasure and health resort of Salt Lake City. It is fitted with a sanitarium, bath-houses, swimming-pool, hotel, restaurant, etc. The water has a natural temperature of 128° F. The following analysis was made by Prof. Hirsching, of the Salt Lake Mining Academy:

BECK'S HOT SPRINGS.

Muriated and Sulphated Saline.

One U. S. gallon contains:[1]

Solids.	Grains.
Sodium carbonate	14.63
Sodium sulphate	140.96
Magnesium sulphate	26.87
Potassium sulphate	10.61
Sodium chloride	598.33
Potassium chloride	8.45
Magnesium chloride	7.28
Calcium chloride	6.52
Calcium carbonate	23.61
Magnesium carbonate	5.88

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[1] Converted from grammes per cubic centimetre.

One U. S. gallon contains :

Solids.	Grains.
Iron carbonate	0.46
Sodium borate	0.23
Calcium borate	0.12
Silica	1.23
Undetermined	3.67
Total	848.85

Sulphureted hydrogen gas, large quantities.
Carbonic acid gas, large quantities.

Although heavily mineralized, this water is perfectly clear, and when taken cold is entirely palatable. It has a diuretic and cathartic influence when used internally. The baths here are said to be highly efficacious in chronic metallic poisoning, tertiary syphilis, obstinate rheumatism, gout, and skin affections.

MIDWAY WARM SPRINGS,

WAHSATCH COUNTY.

Post-office, Midway. Accommodations for fifty visitors. Access from Salt Lake City *via* Utah Central R. R. to Park City, and thence by stage to springs. The location of these springs is in a valley about eight miles square, surrounded by high mountains. The altitude of the resort is about 5500 feet above the sea-level. The temperature of the region varies from 85° F. in summer to 25° F. during the winter months. We are informed by Mr. Thomas Monks, who owns one of the largest springs, that the water deposits a large proportion of its solid contents as it flows. The constant accumulation of this deposit, which is calcic in character, has led to the formation of natural basins around the springs, known as "pots" among the settlers. Some of these pots or basins have attained a great height, the one owned by Mr. Monks having an altitude of 90 feet and a diameter of 200 feet across the top. Some of these natural reservoirs have become entirely dry, while others have standing water in them, with no apparent outlet. The pots are about thirty in number. The flowing springs yield from 300 to 1200 gallons per hour. The water ranges in temperature in the different springs from 85° F. to 112° F. An analysis of one of the springs by Dr. A. Meacham, of Salt Lake City, showed the following mineral ingredients :

MIDWAY WARM SPRINGS.

Alkaline-saline-calcic.

One U. S. gallon contains :

Solids.	Grains.
Sodium chloride	19.81
Sodium carbonate	1.54
Calcium carbonate	58.18
Magnesium carbonate	5.32

One U. S. gallon contains:

Solids.	Grains.
Iron carbonate	1.05
Magnesium sulphate	3.57
Calcium sulphate	6.83
Sodium sulphate	3.15
Aluminium sulphate	0.56
Silica	2.73
Potassium compounds	Traces.
Nitrogen	"
Total	102.74

Carbonic acid gas, considerable quantities.

This analysis shows a fairly strong alkaline-saline water. It should possess the properties of a mild saline cathartic and diuretic when taken internally. It also contains sufficient iron to give it some tonic influence. The springs are resorted to by the settlers to some extent, but no studies of their therapeutical action seem to have been made.

SALT LAKE HOT SPRINGS,

SALT LAKE COUNTY.

Post-office, Salt Lake City. Hotel and sanitarium. The springs are located in the northern outskirts of Salt Lake City. The water is conducted from thence to a sanitarium and bathing establishment in the heart of the city. This fine, commodious structure has a floor space of about 50,000 square feet. The water, at a temperature of 112° F., is drawn from the springs through an eight-inch pipe, with a flow of about 400 gallons per minute, and enters the establishment at a temperature of 110° F. Besides large separate swimming pools for men and women there are twelve private pools and a number of elegant private bath-rooms. A hotel and gymnasium are also connected with the enterprise in the same building. According to an analysis by H. Hirsching, analytical chemist, in 1893, the water contains rather more than 300 grains per United States gallon of solid ingredients. This is largely composed of chloride of sodium (about 200 grains), but the water also contains appreciable quantities of the chlorides of calcium and magnesium, the sulphates of sodium, calcium and magnesium, the carbonate of sodium, and small amounts of several other compounds. It is also charged with sulphureted hydrogen in small quantities, as well as a considerable percentage of carbonic acid gas. The water is useful in the various ailments for which hot saline sulphur baths are prescribed.

UTAH HOT SPRINGS,

BOX ELDER COUNTY.

Post-office, Utah Hot Springs. Hotel. Access *via* Southern Pacific and Union Pacific Railroads. The Utah Hot Springs Company's Steam Motor Line runs in connection with the Ogden City Street Electric Line.

These springs flow from the western base of the Wahsatch Mountains into the Salt Lake valley, about nine miles north of the city of Ogden. They are located at an elevation of 4246 feet above the sea-level. The mountains here are very rugged and picturesque, and attain an elevation of more than 5000 feet above the location of the springs. As shown by the reports of the United States Signal Service, the climate of the Salt Lake valley is exceedingly mild in winter and free from oppressive heat during the summer months. The atmosphere is very invigorating and beneficial to almost all classes of invalids. There are three large springs in the group, and when discovered they resembled three immense wells, twenty to thirty feet in diameter and eighty to one hundred feet deep. Each of these furnishes a large stream of clear, hot, sparkling water, their combined outflow being about 160,000 gallons in twenty-four hours. The temperature varies from 131° F. to 144° F. An analysis by Prof. Spencer F. Baird, Smithsonian Institution, Washington, D. C., resulted as follows:

UTAH HOT SPRINGS.

Muriated-saline. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	18.07
Calcium chloride	170.49
Potassium chloride	97.74
Sodium chloride	1052.47
Magnesium chloride	1.07
Magnesium carbonate	11.77
Silica	2.69
Alumina	0.25
Total	1354.55

Carbonic acid gas, 37.18 cubic inches.

The Hot Springs Hotel is a frame structure, about three hundred feet long, the north end of which is used for baths. The resort is exceedingly well supplied with bathing facilities, containing, besides many private rooms, a large plunge bath for ladies and another for gentlemen, and an immense swimming pool. The water is quite a strong muriated saline. It contains, in addition to the mineral ingredients, a large amount of organic matter in the form of vegetable growths or algæ. It forms rapidly in reservoirs containing the water, and is said to impart a soft, unctuous, or oleaginous effect to the water, which is very pleasing to the skin, and believed to be soothing to the nervous system. The baths are much resorted to by persons suffering from rheumatism, gout, syphilis, chronic bronchial catarrh, obstructive jaundice, disorders of menstruation, etc.

OTHER HOT SPRINGS OF BOX ELDER COUNTY.

A magnificent group of hot springs is located in the northern part of Box Elder County, seven miles from Collinston Station, on the Utah Northern branch of the Union Pacific R. R. These springs are on the property of the Corinne Mill Canal and Stock Company, at the northern extremity of the Bear River valley. They have an elevation of about 4200 feet above the sea-level. The Wahsatch Mountains are close by, but the surface immediately around the springs is dotted with thriving farms. The springs are entirely without improvement so far, but are resorted to by residents of the neighborhood for the treatment of rheumatism. They are about thirty in number, and some of them of immense size. We are informed by Mr. T. D. Cliff, of the Corinne Company, that the largest is four hundred by two hundred feet across, while its depth in the centre has never been ascertained. The springs yield an immense amount of water—according to Mr. Cliff, "a current large enough to form a pretty fair mill stream." They range in temperature from 96° F. to 132° F. A fine resort will no doubt be established here in the near future. The meteorological conditions are about the same as those prevailing at Salt Lake City.

VIRGIN HOT SPRINGS,

WASHINGTON COUNTY.

Post-office, Washington. Visitors accommodated in ranches near-by. These springs are located on the Rio Virgin, four miles south of Toguerville. The nearest railroad station is at Milford, Beaver County, eighty miles distant, by private conveyance. The elevation here is 3200 feet above the sea-level. The surrounding country is of a rugged, mountainous character. According to Mr. Thomas Judd, of St. George, Washington County, the rainfall does not exceed 3½ inches annually. The air is mild, sweet, and balmy, even during the winter months. On February 27, 1896, the date of Mr. Judd's letter, almond and apricot trees were in full bloom in the open air. The springs are six in number, and supply a stream large enough to run a grist mill. The temperature of the water is 132° F. No analysis has yet been made. The springs have not been much improved as yet, but are resorted to by the settlers for rheumatism, skin diseases, and other affections. It is the intention of the present owners to put the springs into proper shape as a health resort as soon as the railroad has been completed to within a reasonably accessible distance.

WARM SPRINGS,

SALT LAKE COUNTY.

Post-office, Salt Lake City. These springs are situated at the base of the heights of Ensign Peak, on West Second Street, Salt

Lake City. The location is about 4060 feet above the sea-level, or 20 feet above the general level of the Salt Lake valley and 40 feet above the lake itself. The springs are the property of the city, and are leased by the present managers for a period of ten years. An excellent bath-house, easily accessible from all parts of the city by electric cars, is maintained at the springs. The water has a temperature of 112° F. as it flows. It was analyzed by Dr. Charles T. Jackson, of Boston, with the following results:

WARM SPRINGS OF SALT LAKE CITY.

Muriated-saline.

One U. S. gallon contains:

Solids.	Grains.
Calcium and magnesium carbonate	10.22
Iron peroxide	1.70
Calcium	23.21
Chlorine	147.14
Sodium	125.66
Magnesium	15.86
Sulphuric acid	29.94
Total	353.73

WASATKA MINERAL SPRINGS,[1]

SALT LAKE COUNTY.

These springs are located in the northern outskirts of Salt Lake City. "Wasatka," or the "Milk Spring," derives its name from the peculiar soft and milk-like flavor of the water. During the past three or four years this water has come into extensive use, and it is said to give ample evidence of remedial value, besides furnishing an excellent table beverage. The following is a recent analysis by Walter S. Haines, Professor of Chemistry at the Rush Medical College of Chicago:

WASATKA MINERAL SPRINGS.

Muriated-saline-calcic.

One U. S. gallon contains:

Solids,	Grains.
Sodium chloride	230.88
Potassium chloride	3.06
Magnesium chloride	21.24
Calcium chloride	11.92
Lithium chloride	0.12
Ammonium chloride	0.25
Calcium sulphate	59.50
Calcium carbonate	4.75
Sodium borate	Traces.
Magnesium bromide	"
Silica	0.75
Iron and aluminium oxide	0.03
Total	332.50

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[1] From "Resources and Attractions of Utah," 1893.

The water possesses alterative, aperient, and diuretic properties, and is recommended by Utah physicians in functional diseases of the digestive organs, liver and kidneys. It is bottled and shipped to many points in Utah and the adjoining States.

VERMONT.

This little State is situated between the parallels of 42° and 45° north latitude, and 71° 25′ and 73° 26′ west longitude. The surface is greatly diversified, so that the scenery is everywhere attractive and often grand. The Green Mountains follow a southwesterly trend, and divide the State into two nearly square portions. Near Canada there are two ranges, the western being the larger; but close to the 44th parallel they unite and continue through Western New England as a single range. The highest peak is Mount Mansfield, 4430 feet, and there are several others over 4000 feet in elevation. Except upon the loftiest summits, the entire range is covered with forests of spruce (*Abies Nigra*), pine, fir, and hemlock, mingled with which are other evergreen and deciduous trees (hence the old French name, Verd Mont). The State has numerous small streams, most of which flow into Lake Champlain, Lake Memphramagog, and the Connecticut River. The surface is dotted with many small lakes and ponds. The climate of Vermont, like that of New England generally, is subject to great variations and sudden changes. In summer the temperature varies from 65° F. to 75° F., sometimes rising to 90° F., while in winter it ranges from 18° F. to 15° F., occasionally falling to —10° F. or even —20° F. At Burlington the mean annual temperature is 45° F. The average rainfall is about 36 inches. The air is clear and pure, and the people, as a rule, robust and vigorous. The charming lake and mountain scenery of the State has brought it into great prominence as a summer resort for tourists and pleasure seekers, and many wealthy and aristocratic families from the Eastern cities now maintain their summer homes on the borders of Champlain or in the leafy recesses of the Green Mountains. The mortality-rate, as computed from the United States census of 1890, was 16.32; phthisical mortality-rate 1.99 per 1000 of population.

For so small a State Vermont is very liberally supplied with mineral springs. None of them has attained a national celebrity, but several are quite important and furnish valuable waters. Almost all varieties of springs (except thermal) are found in the State. As a rule, they are more highly mineralized than those of the other New England States. The following account of the Vermont springs is derived chiefly from a personal investigation in the State. Those whose present status we have been unable to verify are denoted thus *.

*ALBURGH SPRINGS,

GRAND ISLE COUNTY.

Post-office, Alburgh Springs. Hotels. Access *via* Vermont Central R. R. to Alburgh Springs Station; thence one mile to springs.

This is an old-time New England spring resort, having been in use since the year 1816. The springs are located on the shores of Missisquoi Bay, surrounded by picturesque lake and mountain scenery. They are about eighty rods from the water's edge and 30 feet above the level of Lake Champlain. There are two springs, the northern one being somewhat ferruginous. The other spring was analyzed by Dr. C. T. Jackson in 1868, with the following results:

ALBURGH SPRINGS.

Saline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium sulphate	7.11
Potassium sulphate with potassium sulphide	9.50
Sodium chloride	8.76
Magnesium chloride	5.02
Calcium chloride with calcium carbonate	4.81
Insoluble matter	0.80
Organic soil, acid, and loss	2,00
Total	38.00

The water gives off a large quantity of sulphureted hydrogen, and is distinctly alkaline from excess of sulphide of potassium. A quantitative analysis by Prof. Chandler, of New York, is said to have shown also the presence of the bicarbonates of lithia and strontia.

CLARENDON SPRINGS,

RUTLAND COUNTY.

Post-office, Clarendon Springs. Hotel and cottages. Access *via* Delaware and Hudson R. R. to West Rutland Station; thence four miles to springs. This point is seven hours by rail from New York, five hours from Boston, three hours from Troy and Albany, and two hours from Saratoga.

The springs are four in number, and are located in a beautiful valley among the green hills at a level of 1000 feet above the sea. This is doubtless one of the oldest resorts in the country, the medicinal character of the water having been discovered by one Asa Smith, it is said, in the year 1776. From 1500 to 2500 persons visit the springs annually in pursuit of health and pleasure. Amid the beautiful scenery, pleasant drives, and rare opportunities for trout fishing the visitor may while away the summer days in a delightful manner. The hotels are said to be of an excellent character. The following analysis was made by Prof. Hayes, State assayer of Massachusetts:

CLARENDON SPRINGS.

Light Saline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	3.02
Calcium chloride, Sodium sulphate, Magnesium sulphate,	2.74
Total	5.76
Gases.	**Cubic inches.**
Carbonic acid	46.16
Nitrogen	9.36

This analysis is evidently incomplete, and a re-examination is desirable. The water is a very pure and wholesome beverage in addition to its medicinal qualities. It is used commercially.

DEARBORN SPRING,

(*Formerly known as the "Old Sanderson Spring."*)

WINDSOR COUNTY.

Post-office, Woodstock. This spring is located in Woodstock, about three miles from the famous Woodstock Inn. A fine, level road leads to within three-quarters of a mile of the spring, a good hill road covering the remainder of the distance. The spring was discovered about 1830, and soon gained a considerable reputation among the neighboring farmers for its good effects in dyspepsia and skin diseases. The water was analyzed about 1850 by one of the professors in the Woodstock Medical School. The analysis has been lost, but it is said that, among other ingredients, magnesia, iron, and sulphur were found. It is said to resemble the Poland Springs water of Maine. In 1890 the spring passed into new hands, and the owner had it excavated to the bed-rock, thoroughly cleaned, and stoned up to within four feet of the surface, and then tiled and carefully protected from surface water. The tiling was extended upward through a tight floor and a building erected over the spring, with easy facilities for raising the water. The location is now enclosed in a beautiful park, with avenues leading to the spring. Its elevation is 900 feet above Woodstock Park and about 1600 feet above the sea-level. The atmosphere is pure and invigorating, and a number of fine views may be had from the park surrounding the spring. The water of the spring maintains an even temperature throughout the year, which fact would indicate that it proceeds from a great depth. It is icy cold when the temperature of the surrounding air stands at 90° F. in the shade.

ELGIN SPRING,

ADDISON COUNTY.

Post-office, Vergennes. Boarding-houses. Access *via* Vermont Central R. R. to Vergennes; thence three miles south by stage.

This resort is pleasantly located in the Champlain Valley, surrounded by beautiful scenery and delightful drives. The summer temperature generally ranges from about 50° F. to 70° F., and the weather is usually clear and bracing. The following analysis of the spring was made in 1889 by Henry M. Sully, of Middlebury College:

ELGIN SPRING.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Silica	1.19
Calcium	24.61
Magnesium	25.10
Sodium	11.30
Chlorine	0.34
Sulphuric acid	87.65
Carbonic acid	1.08
Iron	Traces.
Total	151.27

Temperature when drawn, 45° F.

The compounds formed by these acids and bases have not been designated by the chemist, but it can readily be seen that they would consist largely of sulphates, with an admixture of carbonates and chlorides. The water contains a considerable proportion of sulphate of magnesium and some sulphate of sodium, which gives it a cathartic effect. It resembles the waters of Seidlitz and Pullna, in Bohemia, and is valuable in chronic constipation and in blood disorders. The water is slightly opalescent when fresh, faintly alkaline to test-paper, and odorless. It becomes perfectly clear after standing.

EQUINOX SPRING,

BENNINGTON COUNTY.

Post-office, Manchester. Equinox and other hotels in Manchester. Access *via* Bennington and Rutland R. R.—a link in the Central Vermont line between Montreal and New York. The location is two hundred miles north of New York and fifty miles northeast of Saratoga. Manchester-in-the-Mountains, a charming village in the southwestern part of Vermont, is situated on a plateau about 200 feet above the Battenkill River and 1000 feet above tide-water, in a valley between the Green and Taconic Ranges. For nearly half a century it has been one of the principal resorts of New England, famed alike for its beautiful scenery, fine drives, healthful, invigorating air, pure water, and numerous brooks alive with trout. The place has been properly termed a model village, the main street being bordered by wide lawns, overarched by century-old elms and maples. Shaded by these trees are marble sidewalks, and back of them the cottages, in their setting of emerald, the entire absence of fences on the street giving the effect of a park. The village contains a beautiful new library building, charming drives in all directions, a strictly first-class hotel (the Equinox), and other desirable features too numerous to mention here. In the immediate vicinity is an unending variety of natural attractions. Away off on Mount Equinox, 1500 feet above the village and 2500 feet above the level of the sea, and far from any habitation, is located the spring which supplies the Equinox mineral water. An analysis of this water in 1892 by Messrs. Chandler and Pellew, of New York, showed the following ingredients :

EQUINOX SPRING.

Light Alkaline-calcic.

One U. S. gallon contains :

Solids.	Grains.
Sodium bicarbonate	0.55
Sodium chloride	0.48
Potassium sulphate	0.08
Calcium sulphate	0.15
Calcium bicarbonate	1.98
Magnesium bicarbonate	0.73
Iron oxide and alumina	0.01
Silica	0.18
Organic and volatile matter	Traces.
Total	4.16

This water has become well known for its purity and softness. It is widely used in the hotels, clubs, and private residences of many of our large cities as a drinking water. It is very lightly mineralized, as shown by the analysis; yet it is recommended by numerous medical men as being useful in the treatment of gout, rheumatism, dyspepsia, and diseased conditions generally which are traceable to the uric-acid diathesis.

*HIGHGATE SPRING,

FRANKLIN COUNTY.

Post-office, Highgate. Hotels. Access : Highgate is three and one-half miles from Swanton, a station on the Vermont Central R. R. and twelve miles north of St. Albans.

A sulpho-saline spring at Highgate is mentioned in Bulletin 32 of the United States Geological Survey. It is also described in Walton's work on mineral springs. In response to inquiries we have received circulars descriptive of the hotels and cottages in the vicinity, but no mention is made of the spring. It is probably of an unimportant character. Highgate is pleasantly located on Lake Champlain, and the neighborhood abounds in charming and picturesque scenery. It is a favorite point for summer tourists.

MIDDLETOWN MINERAL SPRINGS,

RUTLAND COUNTY.

Post-office, Middletown Springs. Hotel. Access *via* Delaware and Hudson R. R. to Poultney; thence a short drive by stage to springs. The location is fourteen miles from Rutland (where tally-ho stage also meets trains during the season) and seventy-five miles north of Troy, New York.

This charming resort is located 3000 feet above tide-water, on the westerly slope of the Green Mountains. Both nature and art have done much to render it a delightful summer resting-place. The high elevation is a guarantee of pure, wholesome air and absence from many of the common insect pests. The Hotel Montvert is said to be the largest building of this kind in the State, having accommodations for three hundred and fifty guests. The appointments are of a high order of excellence. Large and airy rooms, breezy halls, and broad piazzas contribute to the comfort of the guests. There is also a handsome billiard-room and bowling alley. From the piazza a fine view can be had of many of the well-known Green Mountain peaks. Connected with the hotel is a beautiful park of fifty acres, artistically laid out in lawns and walks, with enticing shady nooks on every hand. Ample provision is made for the wants of children, young people, and lovers of croquet, tennis, and other outdoor games. The surface of the ground in the neighborhood is formed of hard limestone rock natural to the country, which gives the roads a macadamized smoothness. This fact renders the neighborhood very attractive to bicyclists. The roads are lined with shade trees, and wayside springs are found at frequent intervals. There are also ample resources for fishermen and the lovers of horseflesh and amateur photography.

The springs are situated on the hotel grounds, near the north bank of the Poultney River. Around the springs is a beautiful grove of shade trees, with pleasant walks, garden chairs, and settees. The springs have been used by white men since 1811, and, according to tradition, for an untold prior period by the aborigines. An analysis was made some years ago by Peter Collier, at that time analytical chemist of the University of Vermont:

MIDDLETOWN SPRINGS.

Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	0.12
Calcium carbonate	2.80
Magnesium carbonate	1.05
Iron carbonate	1.11
Manganesium	0.98
Aluminium	0.07
Potassium chloride	1.08
Sodium chloride	0.18
Sodium carbonate	2.68
Total	10.07

This water is highly recommended in cases of gout, rheumatism, anæmia, dyspepsia, and general debility. The water of the "Montvert" Spring supplied to the guests of the hotel is not, strictly speaking, a mineral water. An analysis by Prof. Doremus, of New York, showed the presence of a trace of iron. It is slightly acidulous and very palatable, and possesses the qualities of an excellent table water. It is bottled and sold by druggists and grocers.

MONTEBELLO SPRINGS,

(*Formerly Newbury Springs.*)

ORANGE COUNTY.

Post-office, Newbury. Hotels. Access *via* Boston and Maine R. R., Passumpsic division.

These springs are located in the midst of pleasing and picturesque scenery in the northern Connecticut valley. From no other point does the White Mountain range present more majestic and impressive views than from "Montebello," or Beautiful Mountain, and from no other point on the river are more varied, extensive, and charming valley and meadow landscapes visible to the eye. Two springs are mentioned in the Geological Reports, but it appears that only one is developed. The water was analyzed by Prof. Hall about 1866 with the following result:

MONTEBELLO SPRING.

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	0.40
Magnesium carbonate	0.24
Calcium carbonate	17.60
Potassium nitrate	0.40
Sodium sulphate	0.24
Iron phosphate	0.40
Sodium chloride	0.32

One U. S. gallon contains:

Solids.	Grains.
Sodium sulphide	0.32
Iron oxide	Trace.
Insoluble silica	8.80
Organic matter and ammonia	0.24
Loss	8.64
Total	37.60

This analysis presents a mild alkaline-calcic water. It ought to possess diuretic and light antacid properties, besides being somewhat tonic. It has long been resorted to, especially for the treatment of rheumatism and cutaneous diseases. Excellent bathing facilities are provided for guests.

*SHELDON SPRINGS,

FRANKLIN COUNTY.

Post-office, Sheldon. Hotels. Access *via* Vermont Central R. R. to St. Albans; thence *via* Missisquoi Valley R. R. to Sheldon. Persons going to Sheldon Spring, one of the group, should buy tickets for Congress Hall Station, eight miles east of St. Albans.

These springs are charmingly situated along the banks of the Missisquoi River, at an elevation of about 2000 feet above the sea-level. Within sight are Mount Mansfield and others of the Green Mountains. Delightful breezes prevail during the summer season, while many nearby points of interest attract the seeker after outdoor recreation and amusement. The springs are four in number—the "Central," within the village; the "Vermont," half a mile from the village; the "Missisquoi," one and a half miles northward, and the "Sheldon," two miles from the village. The waters of the latter spring were analyzed in 1867 by Prof. S. Dana Hayes, and found to contain the following mineral ingredients:

SHELDON SPRING.

Alkaline-saline-silicious.

One U. S. gallon contains:

Solids.	Grains.
Sodium	4.01
Potassium	0.09
Magnesium	0.17
Calcium	1.08
Ammonium	Trace.
Iron oxide	0.01
Sodium	0.15
Chlorine	0.16
Sulphuric acid	0.51
Carbonic acid	2.11
Silicic acid	4.59
Organic matter and crenic acid	2.87
Total	15.75

This water has been found to possess a very useful action in uric acid gravel, gout, and catarrhal states of the bladder. Some years ago it was supposed to have a potent influence in the treatment of cancer, and attracted wide attention as a remedy in this disease. A study of the mineral contents of the water, however, will show no reason to explain any special action which this water might possess in that disease. Whatever benefit has been observed from its use was doubtless due to the good influence of the water in promoting general nutrition by aiding the digestion, stimulating the appetite, etc. A new analysis in accordance with more recent methods is desirable. As far as we can learn, the other springs have never been analyzed. The waters of the Missisquoi Spring are found on the market.

VERMONT MINERAL SPRINGS,

WINDHAM COUNTY.

Post-office, Newfane. Numerous summer hotels in vicinity. Access *via* Brattleboro and Whitehall R. R. to Newfane; thence two and one-half miles northeast to springs

These springs are located in the town of Brookline, fifteen miles north of Brattleboro. The situation is on Putney Heights, half a mile east of the West River and 700 feet above the surface. The scenery in the vicinity is very pleasing. The situation of the springs commands a view of parts of three States, and includes many points of great beauty and attractiveness. The carriage drives are numerous and very pleasant. Visitors will find excellent accommodations in several summer hotels in the vicinity. The springs are two in number, but only one of them has been improved. This spring issues from a small crevice in an enormous ledge of rock. The water is always cold, but never freezes as it flows from the spring. The discharge is about 32 gallons per hour. The company controlling the spring own a large tract of land surrounding it, and are thus able to protect the water very thoroughly from surface pollution. It has been recently analyzed by Prof. S. P. Sharples, State Assayer of Massachusetts, with the following results:

VERMONT MINERAL SPRING.

Light Saline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Iron sulphate	1.01
Calcium sulphate	0.64
Magnesium sulphate	0.41
Sodium sulphate	0.93
Sodium chloride	0.05
Silica	0.76
Total	3.80

This cannot be termed a powerful mineral water, yet it contains iron in sufficient amount to give it useful properties as a ferruginous tonic. Abundant clinical experience goes to show that it has valuable reconstructive properties. It has been found useful in cases of anæmia and debility, enfeebled digestion, anorexia, and in functional disorders of the kidneys. Locally it is recommended for insect bites, erysipelas, conjunctivitis, etc. The water is shipped in pint- and quart-bottle cases.

*WILDEN SPRING,

Franklin County.

Post-office, St. Albans. Hotels in St. Albans. Access: St. Albans is a prominent railroad station on the Vermont Central R. R., in the extreme north corner of the State.

St. Albans is a delightful town, overlooking Lake Champlain, two miles west. The spring is situated on Edwards Street, south of Lake Street, about ten minutes' walk west of the depot. The water was analyzed by A. A. Hayes, M.D., of Boston, who found the following chemical constituents:

Sodium carbonate.
Magnesium carbonate.
Calcium carbonate.
Sodium chloride.
Potassium sulphate.
Calcium sulphate.
Magnesium iodide.
Iron crenate.
Sodium silicate.

Solid constituents per U. S. gallon about 24 grains.

The water has been considerably resorted to in the past, but as far as we can learn it is not now employed for medicinal purposes.

Additional Vermont springs:

Barre Mineral Springs, Barre, Washington County; sulphureted.

Brunswick White Sulphur Springs, Brunswick, Essex County; chalybeate and sulphureted.

Haynes Mineral Springs, Hardwick, Caledonia County.

Lunenburgh Chalybeate Spring, Lunenburgh, Essex County.

Sulphur Springs, in western part of Sudbury, Windham County.

We have the names of a number of other springs in the State, but our information goes to show that they are not at this time in use.

VIRGINIA.

Virginia extends from 36° 30′ to 39° 27′ north latitude and from 75° 10′ to 83° 30′ west longitude. Speaking broadly, the State may be divided into a lowland and a highland country. Its southeastern portion, over 23,000 square miles, or more than half of the whole, has the aspect of a broadly undulating plain that, with but few marked variations of relief, rises from the sea-level to from 400 to 800 feet above it. The northwestern portion is composed of approximately parallel mountain ranges, running entirely across the State from northeast to southwest, separated by nearly parallel valleys, the whole presenting all the varieties of relief peculiar to the Appalachian country between the levels of 800 and 5700 feet. The shore line of the State is divided by the Chesapeake Bay and the great estuaries of the Potomac, the Rappahannock, the York, and the James into five large peninsulas, which are further subdivided by arms of the bay and tidal branches of the rivers into hundreds of smaller peninsulas, thus giving to the State a great wealth of tidal shore outline—fully 2000 miles.

Within the limits of the State all varieties of scenery and climate will be found. The great plateau-valley of Virginia, embracing an area of 7500 square miles, forms one of the most desirable regions in the United States. It is impossible in the brief space of this sketch to dwell upon the many charming features of this favored region. In treating of the individual spring resorts they will occasionally be adverted to. The position and physical conformation of the surface give the State a great variety of climate,—that of the great tidewater and midland plains is a warm temperate; that of the Piedmont and Great Valley is a typically mild temperate; and that of the Blue Ridge plateau and of the high valleys and tablelands of the Appalachian is a more uniformly cool temperate climate than in much higher latitudes. The State is generally noted for the clearness of its skies, the purity of its air, and its freedom from great storms. The mean annual temperature, as observed at Richmond, is 57.53° F., and the annual rainfall is about 40 inches. The United States Census returns for 1890 showed a mortality-rate of 14.03 per 1000 of population. The phthisical death-rate was 1.84 per 1000 of population.

Virginia has long been noted for the number and value of its mineral springs, and even to the present time it stands well toward the head of the list in this respect, being exceeded numerically only by California. The famous spring section of Virginia is located in the mountainous region of the Appalachian chain, but springs are also quite numerous in the more level country that stretches from the foot of the Blue Ridge toward the coast. All varieties of mineral waters are shown in the Virginia list, chalybeate and sulphureted springs being most numerous. The thermal springs are limited to the mountain region. The following account was obtained to some extent from standard publications, but chiefly through visits to the State and personal communications and correspondence. Those springs not reporting during the past three years are denoted thus *.

ALLEGHANY SPRINGS,

MONTGOMERY COUNTY.

Post-office, Alleghany Springs. Hotel and cottages. Access *via* Norfolk and Western R. R. to Shawsville Station, thence by carriage or omnibus three and one-half miles to the springs.

The Alleghany Springs are situated on the headwaters of the Roanoke River, on the eastern slope of the Alleghany Mountains. The hotel and principal range of cottages occupy smooth and undulating hills, gently sloping to a broad grass-covered lawn of forty acres, extending to the banks of the river. The accommodations here are first-class, affording every convenience and comfort to the pleasure-seeker, as well as to the invalid. The hotel is large and spacious and supplied with all requisite improvements. Contiguous to the hotel are over one hundred and fifty double cabins, arranged with a view to the comfort and good health of the guests. The scenery in the vicinity is not excelled for picturesque loveliness and variety at any watering place in the Old Dominion. Only one spring is in use at the present time; it yields about 30 gallons per hour. The water is limpid and has a temperature of 56° F. The following analysis was made some years ago by Dr. F. A. Genth, of Philadelphia:

ALLEGHANY SPRINGS.

Sulphated-(magnesic)-saline.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	3.61
Magnesium carbonate	0.36
Lithium carbonate	Trace.
Strontium carbonate	0.06
Barium carbonate	0.02
Magnesium carbonate	0.06
Iron carbonate	0.16
Cobalt carbonate	Trace.
Zinc carbonate	"
Copper carbonate	"
Lead carbonate	"
Sodium sulphate	1.72
Calcium sulphate	115.29
Magnesium sulphate	50.88
Potassium sulphate	3.70
Magnesium nitrate	3.22
Aluminium nitrate	0.56
Aluminium phosphate	0.03
Aluminium silicate	0.21
Sodium chloride	0.28
Calcium fluoride	0.02
Antimonium oxide	Trace.
Silica	0.88
Crenic acid	Trace.
Apocrenic acid	"
Organic matter	2.00
Total	183.06

Gases.	Cubic inches.
Carbonic acid	0.56
Sulphureted hydrogen	Trace.

This water is distinguished by the great variety of its mineral constituents. The most important of these is the sulphate of magnesia; but it is undoubtedly true that some of the other ingredients, though present in small proportion, modify the physiological effects of the water to a considerable extent. When taken in large quantities it is actively diuretic and cathartic, operating with special activity on the mucous membrane of the lower intestines. In smaller doses its action may be described as tonic, alterative, and detergent. The water has been found of particular benefit in the treatment of dyspepsia, for which it has a wide reputation. Excellent effects are also observed in nervous affections and in diseases of the liver and kidneys. It is recommended in small doses by many physicians in the treatment of anæmia and chlorosis, general debility, and other conditions where tonic and reconstructive effects are sought. The water is bottled and shipped to all parts of the country.

ANTIDYSPEPTIC AND TONIC SPRINGS,

NOTTOWAY COUNTY.

Post-office, Burkeville. Small hotel and boarding-houses. Access *via* Norfolk and Western R. R. and Southern R. R. to Burkeville, thence one-half mile to springs.

These springs are two in number and are located in a healthy section of country about 530 feet above the sea-level. The flow from the main spring, No. 1, is about 240 gallons per hour. The water was analyzed in 1890 by Prof. E. T. Fristoe, of the Columbian University, with the following results:

HARRIS' ANTIDYSPEPTIC AND TONIC SPRINGS.

Light Sulphated-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium hydrate (?)	0.51
Sodium chloride	0.28
Magnesium chloride	0.20
Magnesium carbonate	0.94
Magnesium sulphate	1.30
Calcium sulphate	0.46
Iron oxide	Traces.
Aluminium	0.16
Lithium	Traces.
Calcium carbonate	1.65
Nitric acid	Traces.
Organic matter	"
Sulphuric acid	"
Phosphoric acid	0.78
Silica	1.89
Total	8.17

Free carbonic acid gas, large amount.

It is probable that the acids expressed in the table of analysis are in combination. The water has an extensive reputation in the treatment of dyspepsia and intestinal disorders. It is also believed to possess marked tonic properties.

The water of spring No. 2 is a valuable chalybeate. It contains about ten grains of solid matter per United States gallon, consisting of the salts of sodium, calcium, iron, silica, aluminum, magnesium, and phosphoric acid. It is recommended as a ferruginous tonic. These waters are used commercially and are shipped on order to any desired point.

BATH ALUM SPRINGS,

Bath County.

Post-office, Bath Alum. Hotel and cottages. This resort is located midway between Millboro on the Main Line and Hot Springs on the Valley Branch of the Chesapeake and Ohio Railroad, being ten miles from either point. The springs are situated at the base of Warm Springs Mountain, and are surrounded by a rugged country. The weather during the season, from May to November, is characteristically clear, bracing, and delightful, with few disagreeable days. The springs are five in number. The following analysis of three of them is taken from the United States Geological Reports:

BATH ALUM SPRINGS.

Acid-chalybeate. Aluminous.

One U. S. gallon contains: Solids.	Spring No. 1. A. A. Hayes. Grains.	Spring No. 2. W. H. Taylor. Grains.	Spring No. 3. A. A. Hayes. Grains.
Sodium sulphate	...	1.13	...
Calcium sulphate	3.80	1.71	...
Lithium sulphate	...	Trace.	...
Magnesium sulphate	2.82	0.46	...
Potassium sulphate	...	0.34	0.26
Aluminium sulphate	...	29.99	...
Ammonium sulphate	...	Trace.	...
Manganese sulphate	...	0.03	...
Iron persulphate	...	26.78	...
Aluminium phosphate	...	...	3.15
Ammonium crenate	1.85	...	1.77
Sodium silicate	2.02	...	...
Sodium chloride	0.17	0.11	...
Magnesia	...	...	1.28
Iron oxide	14.52	...	21.77
Alumina	10.29	...	12.29
Silica	...	1.95	...
Sulphuric acid	5.81	2.88	7.88
Carbonic acid	4.14	...	3.85
Apocrenic acid	...	...	2.54
Oxygen with sodium	0.02	...	...
Total	45.44	65.38	54.79

Carbonic acid gas (Spring No. 1), 4.65 cubic inches.

These waters will be seen to be strongly aluminous and chalybeate, with a fair proportion of free acid. They are astringent and tonic in their effects. Thus they have been found useful in chronic diarrhœa and relaxed conditions of the mucous membranes, in skin diseases, and in general debilty.

BEDFORD ALUM, IRON, AND LITHIA SPRINGS,

Campbell County.

Post-office, Bedford Springs. Hotel. Access *via* Norfolk and Western R. R. to Forest Depot, thence four miles by private conveyance to springs. Also *via* Virginia Midland R. R. to Lawyer's Depot, thence four miles by carriage to springs.

These springs are located within a few hundred yards of Bedford Village, one of the ancient historic spots of the Old Dominion, still redolent with memories of Patrick Henry, John Randolph of Roanoke, Thomas Jefferson, and other great Virginians of bygone days. The healthy nature of the location is attested by the longevity of the inhabitants, persons of threescore and ten and over being almost a rule instead of a rare exception. The landscapes about the springs are of great beauty and interest. The Peaks of Otter, twenty miles distant, may be seen raising their lofty crests to an altitude of 4000 feet above the sea. The Natural Bridge is not far distant, and Lynchburg, a city of 20,000 inhabitants, is within ten miles. The location of the springs is about 1300 feet above the sea-level, and the average summer temperature 66° F. The following analysis of the water was made in 1877 by Prof. M. B. Hardin, of the Virginia Military Institute:

BEDFORD ALUM SPRINGS.

Acid-chalybeate. Aluminous.

One U. S. gallon contains:

Solids.	Grains.
Copper sulphate	00.6
Iron proto-sulphate (ferrous)	0.59
Iron persulphate (ferric)	19.26
Aluminium sulphate	24.18
Manganese sulphate	0.19
Zinc sulphate	0.07
Nickel sulphate	0.04
Cobalt sulphate	0.07
Calcium sulphate	4.99
Magnesium sulphate	12.58
Potassium sulphate	0.71
Sodium sulphate	0.87
Lithium sulphate	0.24
Sulphuric acid	4.01
Silica	1.69
Calcium phosphate	0.30
Magnesium nitrate	0.26
Ammonium nitrate	0.24
Sodium chloride	0.20

One U. S. gallon contains:

Solids.	Grains.
Calcium fluoride	Trace.
Organic matter	0.29
Total	70.84

Gases.	Cubic inches.
Carbonic acid	6.98
Oxygen	1.32
Nitrogen	3.33
Total	11.63

Temperature of water, 48° to 56° F.

The properties of the water are tonic, alterative, diuretic, and somewhat astringent. In small doses internally they have been found useful in diarrhœal disorders. In larger quantities they have an aperient effect. They are used in a wide range of diseased conditions. The spring water as well as the evaporated residue ("Bedford Mass") is used commercially and forwarded to any point desired. An excellent hotel is maintained at the springs.

BLUE RIDGE SPRINGS,

Botetourt County.

Post-office, Blue Ridge Springs. Hotel and cottages. Access *via* Norfolk and Western R. R. The hotel is located near the railroad station.

This resort has a picturesque location in the midst of the Blue Ridge Mountains, the elevation being about 1300 feet above the sea-level. The springs yield about 120 gallons of water per hour, having a temperature of 52° F. the year round. It has been analyzed by Prof. Henry Froehling, with the following results:

BLUE RIDGE SPRINGS.

Sulphated-saline. Carbonated.

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	47.01
Calcium sulphate	100.13
Sodium sulphate	0.37
Potassium sulphate	0.65
Magnesium carbonate	1.61
Calcium carbonate	3.96
Strontium carbonate	0.29
Barium carbonate	0.02
Manganese carbonate	0.02
Nickel and cobalt carbonate	Trace.
Iron (ferrous) carbonate	0.11
Lead carbonate	Trace.
Copper carbonate	"
Sodium chloride	1.26
Lithium chloride	0.04

One U. S. gallon contains:

Solids.	Grains.
Sodium arseniate	Trace.
Sodium iodide	"
Sodium bromide	"
Calcium fluoride	"
Magnesium nitrate	0.35
Ammonium nitrate	0.03
Aluminium phosphate	0.02
Aluminium silicate	0.15
Silicic acid	1.35
Total	157.37
Carbonic acid (combined)	2.57

Gases.	Cubic inches.
Carbonic acid (free)	38.20
Sulphureted hydrogen	3.00

The water is used commercially. It is pleasant to drink and bears transportation well. It is useful in dyspepsia, especially when attended by acidity, and it seems to act as a corrigent or regulator of secretion, being efficacious both in diarrhœa and constipation. The water also possesses excellent tonic properties.

BUFFALO LITHIA SPRINGS,

MECKLENBURG COUNTY.

Post-office, Buffalo Lithia Springs. Hotel. Access *via* Southern R. R. to Clarksville, thence eight miles by private conveyance to springs. Also *via* Atlantic and Danville (branch line), which delivers passengers immediately at the springs.

These celebrated springs occupy a central position in the section of country known as the Buffalo Hills, a broken, rolling district, having an average elevation of 500 feet above the sea-level. The hotel is open from June 15th to October 1st. The buildings are on the cottage plan and sufficient for the accommodation of 250 guests. Among the attractions of the place is a well-appointed bathing establishment, affording ample facilities to visitors for mineral-water baths. The springs are three in number, and designated respectively 1, 2, and 3. They have been analyzed by Prof. Wm. P. Joury, of the Maryland Institute, Baltimore. We append the analysis of spring No. 2, which is richest in mineral ingredients:

BUFFALO LITHIA SPRINGS.

Lithic. Aluminous. Calcic.

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	0.88
Aluminium sulphate	9.07
Calcium sulphate	33.06
Potassium carbonate	29.30
Calcium bicarbonate	14.96
Lithium bicarbonate	2.25
Iron bicarbonate	0.30

One U. S. gallon contains:

Solids.	Grains.
Baryta bicarbonate	1.75
Sodium chloride	4.92
Silica chloride	1.87
Phosphoric acid	Traces.
Iodine	"
Organic matter	Small amount.
Total	98.36
Gases.	**Cubic inches.**
Sulphureted hydrogen	8.30
Carbonic acid	59.20

This analysis shows what might be termed more fully an alkaline-carbonated-aluminous-lithic-calcic mineral water. It possesses sufficient iron to give it ferruginous properties, but hardly enough to class it as a chalybeate. The water undoubtedly possesses valuable medicinal properties. The analysis would show it to be antacid, diuretic, and tonic. It has gained a wide reputation, especially in the treatment of the uric-acid diathesis, gout, rheumatism, renal calculus, stone in the bladder, and nervous and gastro-intestinal disorders. Spring No. 3 is a decided chalybeate, containing 3.77 grains of bicarbonate of iron to the standard gallon. It is also somewhat purgative in its action. On account of a heavy precipitate it is not offered for shipment, as are the waters of Nos. 1 and 2. These latter have an extensive sale throughout the country, and the proprietors present testimonials from well-known medical men attesting their merits.

BURNER'S SPRINGS,

Shenandoah County.

Post-office, Woodstock. No hotel at present. Access *via* Baltimore and Ohio R. R. to Woodstock, thence twelve miles to springs; or, *via* Richmond and Danville R. R. to Waterlick, thence twelve miles to springs; or, *via* Norfolk and Western R. R. to Overalls, thence six miles to springs.

The location of these springs is in a beautiful valley, at an elevation of 1500 feet above the sea-level. The country immediately around the springs is level for miles, and presents a pleasing landscape to the eye. The springs are seven in number, which has led to the name of the Seven Fountains sometimes applied to them. They are located within a radius of seventy-five feet, and have a strong, steady flow of water. No analysis appears to have been made. The water is said to afford benefit in gout, rheumatism, dyspepsia, and nervous disorders.

CLAYFORD CHALYBEATE SPRINGS,

Tazewell County.

Post-office, Burke's Garden. Groseclose Inn, two miles distant. These springs are located in a mountain region, about twelve miles from Tazewell, the nearest railroad station. A good pike-road covers the distance. The scenery of this region is picturesque and varied. The main spring is about half-way up the mountain side at an elevation of 3100 feet above the sea-level. The Groseclose Inn is two miles distant, in the famous Burke's Garden, a charming and romantic valley, ten miles long and five miles wide. The surface of the valley itself is smooth and level, and is entirely surrounded by high mountains, except at one gap, through which passes the road leading to the springs. The temperature of the water is 50° F. There are many springs in the little valley, but none of them has been subjected to a chemical examination. The water of the principal spring is said to be an excellent chalybeate, and is recommended by local physicians in anæmia, neurasthenia, and other debilitated states. The surroundings of the springs present many attractions as a health resort.

COLD SULPHUR SPRINGS,

ROCKBRIDGE COUNTY.

Post-office, Goshen Bridge. Hotel. Access *via* Chesapeake and Ohio R. R. to Goshen, thence a drive of two miles to springs. Hacks meet all trains.

The Cold Sulphur Springs are located in the romantic "Mountains of Virginia" at an altitude of 2000 feet above the sea-level. The situation is near the centre of the celebrated mineral spring region, so long noted for the beauty of its scenery and the salubrity of its climate. Recent improvements to the hotel building have greatly increased its capacity, and many additions have been made for the comfort of guests. The location is encompassed on every side by lofty mountains of rare loveliness and grandeur, and the beautiful lawn, with its vast shade of primeval oaks, forms a picture of alluring restfulness and tranquillity. Within a few minutes' drive is the west entrance to the Goshen Pass, the gateway through which the north branch of the James River finds its way to the sea —a spot famous for its wild and magnificent scenery. The water of the Cold Sulphur Springs is clear and slightly sparkling from the gases which it contains. It has a temperature of 50° F. as it flows, and the presence of a large amount of free carbonic acid renders it peculiarly light and grateful both to the taste and to even a delicate stomach. The water has been analyzed with the following results by a chemist whose name is lost:

COLD SULPHUR SPRINGS.

Sulphated, Sulphureted, and Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	2.90
Magnesium sulphate	0.58
Aluminium sulphate	2.46
Sodium sulphate	0.65

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	1.85
Magnesium carbonate	1.78
Iron carbonate	1.22
Sodium silicate	1.48
Calcium chloride	0.42
Lithium chloride	Trace.
Phosphates	"
Organic matter	0.33
Total	13.67
Gases.	**Cubic inches.**
Sulphureted hydrogen	253.00
Carbonic acid	5.65

This analysis shows a mild alkaline-chalybeate. If the figures are correct it contains an unusually large quantity of sulphureted hydrogen. The effects of the water are tonic and sedative. It is used with good effects in diseases of the stomach, bowels, liver, and kidneys. The resort is well provided with facilities for the accommodation, comfort, and amusement of guests.

COLEMANVILLE MINERAL SPRINGS,

Cumberland County.

Post-office, Lucyville. Hotel and cottages. This resort has recently come into notice. Under its enterprising management it gives promise of becoming a vigorous rival to some of the older Virginia spas. The location presents many pleasing features of climate and scenery, but its chief attraction is in the great number and variety of mineral springs in the neighborhood; these are eighty-seven in number. We present the following analysis of two of the best-known springs, made in 1894 by Wm. H. Taylor, State Chemist:

SPRING NO. 7 (COLEMANVILLE MINERAL SPRINGS).

Mild Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Calcium bicarbonate	7.93
Magnesium bicarbonate	5.52
Iron bicarbonate	Trace.
Lithium bicarbonate	"
Potassium sulphate	0.22
Sodium chloride	1.87
Potassium chloride	0.04
Magnesium chloride	0.45
Silica	3.38
Total	19.41

SPRING NO. 19 (COLEMANVILLE MINERAL SPRINGS).

Mild Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Iron bicarbonate	1.69
Calcium bicarbonate	1.52
Magnesium bicarbonate	1.15
Sodium bicarbonate	1.24
Lithium bicarbonate	Trace.
Potassium sulphate	0.13
Sodium chloride	0.15
Potassium chloride	0.05
Silica	2.45
Total	8.38

The water is used in general debility, gastro-intestinal disorders, and derangements of the liver and kidneys.

CROCKETT ARSENIC-LITHIA SPRINGS,

MONTGOMERY COUNTY.

Post-office, Shawsville. Hotel. Access *via* Norfolk and Western R. R. to Shawsville, thence seven miles to springs by carriage.

This resort is located in the Alleghany Mountains, three miles from the Alleghany Springs. The elevation is 2000 feet above the sea-level, and the atmosphere pure, bracing, and delightful. The hotel is a new and substantial structure of artistic design, with a veranda encircling the main building, and is fitted up with modern conveniences. Ample provision has been made for the entertainment of guests. There are bowling alleys, lawn tennis courts, and croquet grounds. Walks, drives, fishing, and hunting are also enjoyed, while many find pleasure in rambling through the woods to the famous Falls, where a bold and sparkling stream leaps for hundreds of feet from rocks and precipices, forming cascades and sprays of great beauty and splendor. The scenery about the resort is romantic and picturesque and affords ever-varying features to charm the visitor's eye. The waters of the Crockett Springs are close to thermal, having a temperature of 70° F. in the coldest winter months. The following analysis was made a few years since by Prof. Henry Froehling:

CROCKETT ARSENIC-LITHIA SPRINGS.

Light Sulphated-saline. Arsenical and Lithiated.

One U. S. gallon contains:

Solids.	Grains.
Magnesium carbonate	1.18
Calcium carbonate	5.90
Strontium carbonate	0.09
Barium carbonate	Trace.
Lithium carbonate	0.07

One U. S. gallon contains:

Solids.	Grains.
Copper carbonate	Trace.
Lead carbonate	"
Zinc carbonate	"
Manganese carbonate	"
Magnesium sulphate	3.04
Calcium sulphate	2.25
Potassium sulphate	1.25
Iron sulphate	0.04
Sodium sulphate	1.86
Sodium chloride	1.23
Sodium bromide	0.01
Sodium iodide	Trace.
Sodium arseniate	0.02
Aluminium phosphate	Trace.
Aluminium silicate	0.12
Ammonium nitrate	Trace.
Silicic acid	1.29
Total	18.35
Carbonic anhydride combined with mono-carbonates to form bicarbonate	3.23
Total	21.58

This water is more distinguished for the variety than for the quantity of its mineral ingredients, yet some of its constituents, though minute in quantity, undoubtedly impart to the water a well-marked therapeutical value. It is said that the well-marked physiological effects of arsenic, for example, may be readily produced by taking the water in large quantities. In practice the water has been shown to act as an eliminating agent, a nerve sedative, a nerve and blood tonic, and as an alterative. It has been found particularly valuable in the chronic types of skin disease, especially those characterized by scaly eruptions. In those varied conditions in which arsenic is useful the water meets the indications perhaps more promptly, with more permanent results, and with less constitutional and local irritation than the artificial preparations of arsenic. The hotel is amply supplied with bathing facilities at any temperature, and good results have followed the conjoint use of the baths and the internal administration of the water. An office has been fitted up for the resident physician, by the management, with the latest and most improved electrical apparatus and other appliances for the treatment of chronic diseases. The water is used commercially.

DAGGERS SPRINGS,[1]

Botetourt County.

Post-office, Daggers. Hotel and cottages. Access *via* James River Branch of the Chesapeake and Ohio R. R. to Gala Water Station, thence three miles by private conveyance to springs.

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[1] Or Dibrell's Springs.

This pleasant resort is located in the foot-hills of the Blue Ridge Mountains in what is known as the game region of Virginia. Its advantages have been tersely set forth as follows:

"Cool breezes, refreshing days, restful nights, no mosquitoes, shady lawn, trout fishing in mountain streams, bass fishing in James River, good hunting in its season, lawn tennis, croquet, etc. Fine mineral waters, sulphur, iron, and lithia, a cool lithia pool bath within easy reach, a hot lithia tub-bath at the hotel. A resident physician, daily mails, comfortable rooms, an old Virginia cook, an old Virginia reel, an old Virginia welcome, and a very moderate bill."

We regret that no complete analyses have been made. The water of the sulphur spring is used in disorders of the liver, stomach, kidneys, and skin, and in rheumatism and chronic constipation. The iron water is said to be useful as a tonic, and is efficacious in anæmia and chlorosis, general debility, and in convalescence from acute prostrating diseases. The lithia waters are used in cases of the uric-acid diathesis, renal and cystic calculus, gravel, etc.

FARMVILLE LITHIA SPRINGS,

PRINCE EDWARD COUNTY.

Pos-office, Farmville. Boarding-houses. Access *via* Norfolk and Western R. R. to Farmville, thence one-half mile to springs.

Farmville is a thriving town of 4000 inhabitants, located fifty-five miles east of Lynchburg and seventy-two miles south of Richmond. The railroad depot is within pleasant walking distance of the springs, but carriages are at hand for all those who prefer to ride. There are many features of interest in this historic region. The springs are beautifully situated about 550 feet above the sea-level. The surrounding country is very pleasing to the eye, and on every hand the visitor is met by names and locations of familiar memory. Not far from the springs are located the battle-fields of Chancellorsville, Appomattox, Rapidan, Five Forks, and others of lesser note. The climate here is bracing and delightful, the temperature ranging from 40° to 50° F. in winter and from 80° to 90° F. in summer. The springs are eight or ten in number, and yield about 50 gallons of water per hour. The following analysis is by Prof. E. T. Fristoe, of the Columbian University, Washington:

FARMVILLE LITHIA SPRINGS.

Alkaline-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	5.30
Sodium sulphate	3.59
Potassium sulphate	0.18
Calcium sulphate	1.81
Lithium bicarbonate	3.76

One U. S. gallon contains:

Solids.	Grains.
Calcium bicarbonate	1.33
Magnesium carbonate	2.71
Ferrous carbonate	1.26
Manganous carbonate	Trace.
Alumina	2.52
Silica	3.92
Iodine	Trace.
Sulphuric acid	Trace.
Organic matter	Small quantity.
Total	26.38

Carbonic acid gas, 74.20 cubic inches.

It will be observed that this water contains a fair proportion of the bicarbonate of lithium. It is also abundantly charged with carbonic acid gas, and contains sufficient sulphate of sodium to give it a mild laxative action. The water has come into wide use as a corrective of the uric-acid diathesis, and is sold in all parts of the country. Its best effects have been observed in gout, renal and vesical calculus, Bright's disease, and dyspepsia. The iron in the water gives it also excellent properties as a ferruginous tonic.

FAUQUIER WHITE SULPHUR SPRINGS,

Fauquier County.

Post-office, Fauquier White Sulphur Springs. Hotel. Access: From Washington *via* Virginia Midland R. R. to Warrenton, fifty-six miles southward, thence a drive of six miles to springs.

The visitor to this favored locality is pleasantly impressed during the forty-minutes' ride from the picturesque town of Warrenton to the springs. The drive is over a finely graded road through a country where the well-stocked farms and handsome residences are indicative of a high degree of thrift and refinement. The springs are charmingly situated among the foot-hills of the Blue Ridge at an elevation of 1000 feet above the sea-level. The surrounding grounds comprise an area of 400 acres in a high state of cultivation, and abounding in shaded walks and drives through hills and valleys. Being sheltered on the west by wooded hills, the location admits of invalids enjoying the open air with safety almost daily throughout the year. The scenery is varied and imposing, and at once excites the enthusiasm of the artist. The clear waters of the Rappahannock River border the western boundary of the park and sweep along the base of the mountains, where the huntsman and the disciple of Izaak Walton will alike find an ample reward for his tramp among the hills or his patience by the water-side. The waters of these springs have been well-known for upward of seventy-five years. As early as 1834 a company was formed of well-known men from Maryland and Virginia, and two large hotels and a number of cottages capable of accommodating 1000 persons were built.

So attractive were the resort and its surroundings that the Legislature of Virginia held a summer session there in 1849. At the beginning of the war the place was in the full blast of prosperity. In August, 1862, it was the scene of a fierce fight between the Federal and Confederate forces, and the two hotels were burned. In 1877 a company was formed for the purpose of restoring the famous old resort to public uses. The present accommodations consist of an elaborate and commodious fire-proof hotel, fitted with all modern improvements. There is besides a number of cottages, capable of accommodating 500 guests, located in a magnificent grove of elms convenient to the main hotel. The following analysis of the spring water was made in 1878 by Prof. Thomas Antisell, of Washington, D. C.:

FAUQUIER WHITE SULPHUR SPRINGS.

Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium bicarbonate	7.88
Magnesium bicarbonate	2.47
Sodium chloride	3.75
Calcium sulphate	3.39
Iron phosphate, Iron sulphate,	2.14
Sodium and potassium sulphate	1.63
Calcium and magnesium phosphate	0.64
Gaseous matter, etc	0.10
Total	22.00

Gases.	Cubic inches.
Carbonic acid	11.00
Sulphureted hydrogen	Small quantity.

Temperature of water at springs, 55° F.

The source of the mineral ingredients of the springs lies in the country rock, which is an aluminium slate, the beds of which lie nearly horizontal, or with a slight slope, and hold between their layers sandy, ferruginous seams, in which are embedded crystals of iron pyrites with some hydrated oxide of manganese. The water is properly classed as a sulphureted alkaline-chalybeate, possessing alterative, tonic, and diuretic properties. It has long been recommended in the various forms of dyspepsia, in intestinal disorders, and in liver complaints. Its diuretic properties are utilized in dropsical affections due to renal and cardiac disease, as well as in the early stages of Bright's disease. In the condition known as neurasthenia, produced by overwork, anxiety, or other causes, a course of this water has been found to be markedly advantageous. In certain female complaints, notably in menstrual disorders due to anæmia, its action is prompt and permanent.

GLENOLA SPRINGS,

(*Formerly Wayland Springs.*)

NOTTOWAY COUNTY.

Post-office, Jennings Ordinary. No accommodations at present. These springs are located in a fine undulating stretch of country, half a mile from Jennings Ordinary, on the Southern Railroad, and six miles from Burkeville Junction on the Norfolk and Western R. R. The location is about 500 feet alove the sea-level, and the climatic conditions of a very desirable character. The average summer temperature range is 77° F., winter 38° F. The temperature of the water is 48° F. There are several springs in the neighborhood, only one of which has been chemically examined. The following analysis was made by Prof. M. B. Hardin, of the Virginia Military Institute :

GLENOLA SPRINGS.

Light Iodic-alkaline-carbonated.

One U. S. gallon contains :

Solids.	Grains.
Sodium carbonate	0.55
Lithium carbonate	0.01
Magnesium carbonate	0.26
Calcium carbonate	0.70
Strontium carbonate	0.03
Iron carbonate	0.06
Manganese carbonate	Traces.
Potassium sulphate	0.05
Potassium chloride	0.09
Sodium chloride	0.34
Sodium iodide	Traces.
Sodium nitrate	0.11
Sodium phosphate	0.01
Aluminium phosphate	0.04
Ammonium nitrate	Traces.
Silica	1.92
Aluminium silicate	0.20
Calcium fluoride (suspended)	Traces.
Titanium dioxide	"
Organic matter	"
Carbonic acid in the bicarbonates	0.71
Total	5.08

Carbonic acid gas, 6.65 cubic inches.

This water is distinguished by the presence in small but perceptible quantities of the iodide of sodium. It may be ranked as an iodic-alkaline-carbonated water. The spring yields about 38 gallons per hour the year round. Since its discovery, in 1883, it has been extensively used in cases of rheumatism, dyspepsia, and renal diseases. The location offers excellent advantages as a health resort, but at the present time it is languishing for the want of capital.

HEALING SPRINGS,

BATH COUNTY.

(See Hot Springs.)

*HOLSTON SPRINGS,

SCOTT COUNTY.

Post-office, Holston Springs. Hotel. These springs are located at the base of Clinch Mountain, on the banks of the Holston River, amid wild and beautiful scenery. The elevation above the sea is 1800 feet. Analysis by Prof. Hayden:

HOLSTON SPRINGS.

Sulphated-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	6.40
Sodium chloride and ammonium chloride	1.52
Sodium sulphate	Trace.
Magnesium sulphate	12.72
Calcium sulphate	20.48
Aluminium sulphate	Trace.
Aluminium phosphate	"
Total	41.12

Temperature of water, 68.50° F.

HOT SPRINGS,

BATH COUNTY.

Post-office, Hot Springs. Hotels and cottages. Access *via* Hot Springs Branch of the Chesapeake and Ohio R. R. Connection is made at Covington, Virginia. Through sleepers to Hot Springs are run in the summer. The Virginia Hot Springs Company run a line of first-class stages to the Warm Springs, five miles north, and to the Healing Springs, three miles south of the terminus at Hot Springs.

The valley containing the Hot, Warm, Sulphur, and Healing springs of Virginia is located in the heart of the Appalachian Mountains, in the first of several lofty ranges that lie east of and parallel with the main Alleghany divide. Some two miles in width, the valley extends for more than a dozen miles between towering mountains, from the crests of which, 4000 feet above the sea, villages and farm-houses with intervening stretches of country, over 1500 feet below, are spread out to the view of the observer as a beautiful panorama. The scenery of the valley is richly colored, bold, and picturesque—a vision of beauty from end to end. The visitor can drive for miles over new boulevards and carefully constructed roads, through a region everywhere attractive and affording a succession of constantly changing landscapes. The view from

Flag Rock, on the eastern mountain summit, is one of the grandest in the world. Limited only by the horizon, the eye sweeps in every direction over a sea of mountain ranges. Far off in the dim distance are well-known peaks; among them, forty miles away, is Elliott's Knob, the highest point in Virginia, and in other directions are House Mountain, near Lexington, Va., and the celebrated twin Peaks of Otter. The view from the western crest is also grand and impressive. The streams formed by the various springs in the valley have pierced the western range and divided it into a series of five tall, distinct mountains, narrowly separated from each other by chasms and gorges. Meandering roads and romantic bridle-paths and footways, bordered with ferns and mosses, penetrate these rugged and secluded passes, and reward the visitor with views of a never-ending variety of cascades and chasms, and enormous bowlders and rocks strewn in inextricable confusion by the tremendous power of the tumbling waters. Among the points in the vicinity well worthy of a visit are the Falling Springs, ten miles from Hot Springs and seven miles from Healing Springs, the cascades of Healing Springs, and Dunn's Gap. Forests and meadows, cliffs and caverns, cascades and brooks, rugged mountains and pleasing pastures, a beautiful flora, abundant game of great variety, and rivers and rivulets stocked with the finest fish, are all at hand to gratify the whims and caprices of the pleasure-seeker.

The altitude of the valley (2300 feet) and its protection by the surrounding mountains from wind-storms and sudden changes combine to produce a temperature safe in winter and delightful all the rest of the year. The air is clear and dry, mists and fogs being rarely seen. The highest summer temperature observed during a series of recent observations was 87° F., the monthly mean for June, July, and August being 68.5° F.

The Hot Springs. These waters have been resorted to for three generations of white men. Physicians of wide reputation and abundant experience have pronounced them equal to the most effective similar waters of the European spas. The drinking-waters are also of great variety, and beside the hot springs there are magnesia, sulphur, soda, and alum springs, each of which is widely recommended for medicinal purposes. The bath-house at Hot Springs is a substantial four-story structure of stone and brick, built in the Colonial style of architecture at a cost of over $100,000. It is fitted up in a sumptuous manner with all the requisites of a modern institution of this kind. All varieties of baths will be found here. The old bath-house has been converted into two large swimming pools, one each for gentlemen and ladies The hotels at Hot Springs are the "Homestead," a charming house of the true old Colonial style, which has been entirely remodelled and modernized, and the "Virginia," a new hotel built in the latest fashion, and supplied with every comfort and convenience. This hotel is kept open all the year. Ten new cottages cluster close by, each with a broad porch and veranda. This hotel is connected with the passenger station, but so arranged that no noise or annoyance is caused by railroad trains. The waters of the Hot Springs have been analyzed by several well-known chemists. The Spout, Boiler, and Sulphur Springs were examined by Prof. Clarke, of the Smithsonian Institution in 1884, and the last two, together with the Soda and Magnesia Springs, have recently been analyzed by Messrs. Dickoré and Morgan, of Cincinnati, Ohio. The several results in the examinations of the same waters have been practically identical. Following are specimen analyses :

BOILER (BATH) SPRING.

Alkaline-saline-calcic. Thermal.

(Analysis by Dickoré and Morgan.)

One U. S. gallon contains :

Solids.	Grains.
Magnesium sulphate	8.48
Magnesium carbonate	3.02
Calcium sulphate	1.89
Calcium carbonate	23.08
Sodium sulphate	3.68
Potassium sulphate	0.69
Potassium chloride	0.54
Silica	1.95
Total	43.33

Temperature, 108° F.

SODA (DRINKING) SPRING.

Alkaline-calcic. Sulphated-saline.

(Analysis by Dickoré and Morgan.)

One U. S. gallon contains :

Solids.	Grains.
Magnesium sulphate	5.90
Magnesium carbonate	2.61
Calcium sulphate	3.22
Calcium carbonate	17.55
Sodium sulphate	2.02
Potassium sulphate	0.88
Potassium chloride	0.21
Silica	0.49
Total	32.88

Temperature, 74° F.

SPOUT BATH SPRING.

Alkaline-calcic. Thermal.

(Analysis by Prof. Clarke.)

One U. S. gallon contains :

Solids.	Grains.
Silica	1.37
Alumina	0.15
Potassium chloride	0.54
Potassium sulphate	1.09

One U. S. gallon contains: Solids.	Grains.
Sodium sulphate	1.64
Calcium sulphate	8.32
Magnesium carbonate	7.02
Calcium carbonate	13.96
Total	34.09

Temperature, 106° F.

These waters resemble considerably in chemical composition those of the Hot Springs of Arkansas. They also resemble those of Aix-les-Bains in France, the French spring having a somewhat higher temperature. Both for internal use and for bathing the waters of the Virgina Hot Springs have gained a wide celebrity in the treatment of many of the ills to which human flesh is heir. The baths here are especially to be commended. The excellent thermal waters with the elegant and elaborate methods of using them may be expected to render all the service in diseased states which can be accomplished by this means. It is especially desired that all those who visit the springs with the intention of using the baths consult a resident physician in regard to the use of the waters.

The Healing Springs Hotel is three miles from the railway station at Hot Springs, from whence it is reached by a comfortable line of stages. There is a telephone connection with the depot and with the hotels at Hot and Warm Springs. No place in the Virginia Mountains is more pleasant or picturesque. The quiet, peaceful grandeur of the surroundings has a powerful effect upon the imagination, and is a potent factor in aiding the recovery of those afflicted with nervous troubles. The air is pure, dry, and bracing, the temperature being uniform and delightful throughout the season. The rooms in the hotel and cottages are large and cheerful; they are kept scrupulously clean, and the management throughout is charmingly homelike and in harmony with the surroundings. The supply of water is abundant, being derived from four springs of essentially the same character, and is beautifully bright and crystalline. Its temperature is uniformly 85° to 88° F. The bathing accommodations have been greatly extended and otherwise improved by the erection of a new bath-house, the addition of several apartments to those already built. The waters of the springs, as will be seen by the analyses, are almost identical with those of Schlangenbad and Ems in Germany. These were made by Prof. Wm. E. Aiken, of the University of Maryland:

OLD SPRING.

Sulphated-saline. Calcic.

One U. S gallon contains: Solids.	Grains.
Calcium carbonate	17.90
Magnesium carbonate	1.24
Iron carbonate	0.07
Calcium sulphate	1.32

One U. S. gallon contains:

Solids.	Grains.
Magnesium sulphate	7.25
Potassium sulphate	2.21
Iron sulphate	0.18
Ammonium sulphate	0.23
Sodium chloride	0.27
Potassium carbonate	0.24
Silicic acid	1.89
Organic acid (crenic?)	0.86
Carbonic acid	2.20
Sulphureted hydrogen	Trace.
Bromine	"
Iodine	"
Total	35.86

NEW SPRING.

Sulphated-saline. Calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	18.72
Magnesium carbonate	1.96
Iron carbonate	0.28
Calcium sulphate	1.26
Magnesium sulphate	7.39
Potassium sulphate	2.53
Iron sulphate	0.10
Ammonium sulphate	0.23
Potassium chloride	0.25
Sodium chloride	0.29
Silicic acid	1.82
Organic acid (probably crenic)	0.88
Carbonic acid	2.29
Sulphureted hydrogen	Trace.
Bromine	"
Iodine	"
Total	38.00

The bubbles of gas that arise from the springs contain in 100 parts: nitrogen gas, 97.25; carbonic acid gas, 2.75.

These waters have proved valuable in a considerable range of diseases; they are diuretic, somewhat laxative and tonic in their effects upon the system. The best results have been observed in chronic congestions of the liver, irritability of the bladder from cystitis, enlarged prostate, etc., the early stages of Bright's disease, and in debilitated states generally.

The Warm Springs are located five miles north of the railroad terminus at Hot Springs. The court-house and county buildings are located here. The springs are picturesquely located in a grand old grove and lawn in the centre of a tract of about 1800 acres, which in width includes the crests of the mountains on either side of the valley. The remarks concerning the scenery, atmospheric conditions, etc., in the description of the Hot Springs apply with equal force to the Warm Springs. An excellent hotel, built in the Colonial style, charmingly situated and well kept, will be found. There are also a number of comfortable cottages. For three generations these springs have been visited by people from all over the United States, with not a few from foreign countries, and even when it involved a long and tiresome journey in primitive stage-coaches they were a favorite resort of the wealth and fashion of Virginia and the South. The ball-room connected with the hotel is one of the finest in the State and has been the scene of many festive occasions. The grand boulevard recently completed between the Hot and the Warm Springs is a magnificent driveway, and passengers will be transported from the Hot Springs Station in comfortable carriages in the brief space of forty minutes after a most enjoyable ride. The gentlemen's bath is an octagon forty feet in diameter, and holds 43,000 gallons of water. The ladies' bath is circular in shape, with a capacity of 60,000 gallons. These pools are supplied from separate springs discharging upward of 60,000 gallons of water per hour, at a temperature of 96° F., which, charged with myriads of bubbles of sulphureted hydrogen gas, rises naturally from the bottom of the pools, affording a delightful and luxurious bath. There are also private baths of various kinds, and ample provision for the comfort and convenience of bathers. An old analysis of one of the springs, made by Prof. A. A. Hayes, shows the following solid constituents :

WARM SPRINGS, VIRGINIA.

Calcic-sulphureted.

One U. S. gallon contains :

Solids.	Grains.
Calcium carbonate	5.22
Calcium sulphate	14.53
Potassium sulphate	1.38
Ammonium sulphate	0.36
Sodium silicate, Magnesium silicate,	1.72
Iron crenate	2.50
Carbonic acid	6.92
Total	32.63

Gases: Sulphureted hydrogen, carbonic acid, and nitrogen.

The water is limpid, has a styptic taste, and the odor of sulphureted hydrogen. The action of the water is sedative, as a rule. Immersion in the bath gives rise to a sense of voluptuous repose; and as the hand passes over the body the surface presents a velvet smoothness, as though anointed with some delicate ointment. This unctuous quality has also been observed in the baths of Molitg in France, and in those of Wildbad near Stuttgart. It has been variously ascribed by European writers to the presence of silicates, to the monosulphuret of sodium, and to an organic matter, the last being the most probable cause. These waters are applicable in chronic and subacute rheumatism, gout, neuralgia, congestive amenorrhœa, and dysmenorrhœa, and in nephritic and calculous disorders, by their soothing effects. The spout bath, arranged with an ascending douche, is especially useful in the type of dysmenorrhœa named. The baths are also beneficial in the squamous skin affections.

HUBBARD SPRINGS,

LEE COUNTY.

Post-office, Jonesville. Access *via* Louisville and Nashville R. R. to Hubbard's Springs Station, thence a walk of two hundred yards to springs.

These springs are located seven miles from Jonesville in Southwest Virginia. The surrounding country is rugged and broken in character, the springs being in a charming valley at the foot of the Cumberland Mountains. The elevation is about 1450 feet above the sea-level. There are four springs located in a space of thirty feet square, and known respectively as the "White Sulphur," the "Black Sulphur," the "Chalybeate," and the "Freestone." An analysis has been made, but the results are not known at this time. The waters are stated to be much valued in rheumatism and in disorders of the liver, kidneys, and gastro-intestinal mucous membrane. No special accommodations are made for visitors, but board and lodging may be obtained in the neighborhood.

HUNTER'S PULASKI ALUM SPRINGS,

PULASKI COUNTY.

Post-office, Sassin. Hotel. These springs are located eight and one-half miles north of Pulaski City, from which point they are reached by carriages and stages. The location is very pleasant and picturesque, being about 2000 feet above the sea-level, and surrounded by beautiful mountain scenery. The average summer temperature at Pulaski Springs is 71.6° F., and malarial disorders are said to be unknown. Immediately surrounding the springs are shady lawns and charming walks and drives, which with the pure air and romantic landscapes, render the place very attractive during the summer months. Excellent fishing and hunting may be had in the vicinity. The springs are two in number. They have been analyzed by Dr. Wm. H. Taylor, State Assayer and Chemist, with the following results :

PULASKI ALUM SPRINGS.

Aluminous. Chalybeate.

One U. S. gallon contains : Solids.	Grains.
Potassium sulphate	0.31
Sodium sulphate	0.32
Lithium sulphate	Trace.
Calcium sulphate	0.99

One U. S. gallon contains: Solids.	Grains.
Magnesium sulphate	1.26
Aluminium sulphate	16.40
Iron sulphate	1.99
Manganese sulphate	Trace.
Sodium chloride	0.11
Silica	3.87
Free sulphuric acid	0.63
Total	25.88

The chemist states that his analysis was not complete, and that further tests would show the presence of additional mineral ingredients. The water is recommended in dyspepsia, diarrhœa, and dysentery, and locally in catarrhal states of the mucous membranes. It is used commercially.

IRON LITHIA SPRINGS,

TAZEWELL COUNTY.

Post-office, Tazewell. Hotel. Access *via* Clinch Valley Division of the Norfolk and Western R. R. to Tip Top Station, thence by private conveyance two miles to springs.

These springs are charmingly located in the Alleghany Mountains at an elevation of 2700 feet above the sea-level. They were but recently discovered, but have already become well known. A hotel has been erected capable of accommodating fifty guests. The many advantages of climate, mineral springs, scenery, etc., which are found here will doubtless bring the place into prominence in the near future. The springs are five in number and discharge about 1000 gallons of water per day. An analysis by Dr. Henry Froehling, of Richmond, in 1890, shows the following ingredients :

IRON LITHIA SPRINGS.

Sulphated-saline. Aluminous and Chalybeate.

One U. S. gallon contains: Solids.	Grains.
Magnesium sulphate	4.71
Calcium sulphate	1.71
Barium sulphate	0.09
Strontium sulphate	Trace.
Iron sulphate	5.08
Manganese sulphate	0.36
Aluminium sulphate	8.05
Potassium sulphate	0.51
Sodium sulphate	0.25
Lithium chloride	0.18
Sodium	0.39
Sodium iodide	Trace.
Aluminium phosphate	0.11
Sulphuric acid (free)	0.51
Silicic acid	1.60
Total	23.55

Carbonic acid gas, 5.20 cubic inches.

This water is distinguished by the not inconsiderable quantity of manganese which it contains. This remedy has been found valuable in certain female complaints, especially in functional amenorrhœa. In addition it contains a very large proportion of iron and alum, and a considerable amount of sulphate of magnesia. Taken altogether, it may be pronounced a very valuable mineral water, and will be found useful in a large class of cases requiring a local astringent, a general ferruginous tonic, or a uterine detergent.

JORDAN'S WHITE SULPHUR SPRINGS,

Frederick County.

Post-office, Jordan's Springs. New hotel. Access *via* Harper's Ferry and Staunton Branch of the Baltimore and Ohio R. R. to Stephenson's Depot, thence by stage two miles to springs.

This well-known summer resort is located in the northeastern part of the beautiful Shenandoah Valley, six and one-half miles from the city of Winchester. The elevation here is 1200 feet above the sea-level. Charming scenery and delightful climatic conditions will be found. The hotel, just completed, is thoroughly modern and sanitary in all its appointments. A new bath-house affords all conveniences for bathing. The springs supply an abundance of water, having an unvarying temperature of 57° F. the year round. Like other sulphur waters, it is at first unpleasant to the taste, but a tolerance and even a liking for the water is quickly acquired. The following analysis was made in 1871 by Thomas Antisell, Chemist of the United States Department of Agriculture:

JORDAN'S WHITE SULPHUR SPRINGS.

Alkaline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	5.13
Potassium sulphate	2.09
Sodium chloride	0.76
Potassium carbonate	9.71
Magnesium carbonate	2.88
Iron carbonate	Trace.
Manganese carbonate	0.01
Hydro-sulphuric acid	0.79
Silicic acid	0.25
Alumina	0.01
Total	21.63

This water has been in use for many years. Its most marked properties are diuretic, aperient, and tonic. It is also believed to possess an alterative as well as a diaphoretic influence. The chief application of the water has been in cases of chronic diseases resulting from derangement of the liver, kidneys, stomach, and blood, and glandular system. It is said to be very beneficial in obstinate cases of gout and rheumatism. The water is sold by the barrel, half-barrel, demijohn, or bottle.

MASSANETTA SPRINGS,

ROCKINGHAM COUNTY.

Post-office, Harrisburg. Hotel and cottages. Access *via* Baltimore and Ohio R. R. to Harrisburg, thence a drive of four and one-half miles southeast to springs.

This resort is located in the Shenandoah Valley, near the Massanutten Mountain, at an elevation of 1350 feet above the sea-level. The waters of the springs have been in use for upward of fifty years, and are still extensively resorted to in the treatment of a variety of affections. They have been analyzed by Prof. Mallet, of the University of Virginia, with the following results :

MASSANETTA SPRINGS.

Alkaline-chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	12.10
Magnesium carbonate	5.78
Iron carbonate	3.12
Manganese carbonate	0.43
Sodium carbonate	0.93
Lithium carbonate	Trace.
Ammonium chloride	"
Potassium chloride	0.13
Potassium sulphate	0.09
Calcium sulphate	0.35
Alumina	0.13
Arsenious oxide (in salt)	Trace.
Phosphoric acid	"
Silica	0.94
Organic matter	0.40
Total	24.40
Carbonic acid united to carbonates as above to form acid salts	8.80

Temperature of water, 55.7° F.

These waters are said to be valuable in the treatment of chronic malarial poisoning, and the managers present numerous testimonials from physicians and others attesting their virtues. It is reasonable to believe, however, that the good effects observed have been in a large measure due to the excellent climatic and sanitary conditions about the springs. The water is an excellent chalybeate tonic, and also has diuretic properties. It is used commercially.

MILLBORO SPRINGS,

Bath County.

Post-office, Millboro. Hotel and sanitarium. Access *via* Chesapeake and Ohio R. R. to Millboro Depot, thence by carriage two miles to springs.

The hotel is situated on a gently sloping eminence about 2000 feet above the level of the sea. The situation commands a fine vista of green fields, fertile valleys, lofty forest-capped hills, and in the distance the towering peaks of the Alleghanies. The climate here is of the usual dry, bracing character of the Virginia mountain region. The hotel is a comfortable, well-kept establishment, having a capacity of 100 guests. Lawn tennis, croquet, bowling, riding and driving, and bat shooting are among the amusements offered. The Wallawhatoola River, half a mile distant, furnishes excellent bass fishing. There are several mineral springs here, the most important being the Sulphur and the Alkaline Springs. The following analysis of the former was made in 1891 by G. B. M. Zerr, chemist, of Staunton, Va.:

SULPHUR SPRING (MILLBORO SPRINGS).

Light Alkaline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium hydro-sulphate	3.34
Calcium sulphate	1.55
Potassium sulphate	0.11
Sodium bicarbonate	4.27
Magnesium bicarbonate	1.65
Calcium bicarbonate	0.54
Iron bicarbonate	Trace.
Alumina	0.26
Sodium silicate	0.89
Sodium chloride	0.47
Aluminium phosphate	Trace.
Organic matter	0.35
Total	13.43

Gases.	Cubic inches.
Sulphureted hydrogen	1.08
Carbonic acid	6 94

This is an excellent water of the alkaline-sulpho-carbonated variety. It possesses antacid, tonic, and mild diuretic properties, and will be found useful in the class of cases to which such waters are applicable. The Alkaline Spring was analyzed by Dr. Zerr in 1895. It is somewhat milder than the Sulphur Spring, but is also a very useful water in acid dyspepsia, enfeebled states of the digestion, etc.

MONTGOMERY WHITE SULPHUR SPRINGS,

MONTGOMERY COUNTY.

Post-office, Montgomery Springs. Hotel and cottages. Access *via* Norfolk and Western R. R. to Big Tunnel Station, thence by a narrow-gauge branch railroad direct to the reception house on the springs lawn.

This attractive summer resort is located in the Alleghany Mountains, at a level of over 2000 feet above tide-water. It is surrounded by the pleasing features which render the old Virginia mountain resorts famous. The high elevation, cool and invigorating atmosphere, delightful scenery, romantic walks, and picturesque drives, together with an excellent and well-kept hotel, serve to make the Montgomery Springs a very desirable point both to the tourist in search of recreation or diversion and to the invalid who seeks to restore his health. Among the objects of interest in the neighborhood may be mentioned the Dudley Cascade, having a fall of ninety feet over a rugged cliff of solid rock. The falls are two and one-half miles from the springs and are reached by a lovely drive over well-graded roads along the banks of the Roanoke River. Twenty-one miles distant is the celebrated Mountain Lake, the next highest point in Virginia, having an elevation of more than 4800 feet. The waters of the springs issue from three bold sulphur fountains, a chalybeate, and freestone spring. They are gathered in handsome marble reservoirs surrounded by tasteful pavilions. Suitable arrangements for warm and cold sulphur baths are provided. A complete analysis of the water is wanting, but we have secured the following facts regarding their medicinal uses. The White Sulphur water contains sulphates and chlorides, the principal ingredients being the sulphates of sodium, calcium, magnesium, and manganese, with a considerable proportion of sulphureted hydrogen gas. It is used with much benefit in disorders of the liver and skin. It acts also upon the system as a mild laxative, a diuretic, and a diaphoretic. The water tends to relieve portal congestion and diminishes abdominal plethora. It is recommended by physicians in malarial affections of the spleen and liver, in rheumatism and gout, in incipient tuberculosis, and in chronic metallic poisoning. The chalybeate water contains a large percentage of carbonate of iron, and also the carbonates of magnesia, lime, lithia, manganese, and a number of sulphates. It is used with much advantage in chlorosis, amenorrhœa, albuminuria, dyspepsia and chronic diarrhœa, and other disorders. The average temperature of the water is about 50° F.

NYE LITHIA SPRINGS,

WYTHE COUNTY.

Post-office, Wytheville. Hotels and boarding-houses. Access *via* Norfolk and Western R. R. to Wytheville, thence two miles over macadamized carriage-roads to springs.

These springs are located in the southwestern part of Virginia, in a charming picturesque locality, one-quarter of a mile from the corporate limits of Wytheville. The elevation of 2360 feet above the sea-level gives assurance of a cool and delightful summer temperature. The country about Wytheville has long been celebrated in the South as a summer health resort, and the yearly visitors come from far and near. The average yearly temperature of Wytheville is 53° F. The seasonal temperatures are as follows: Spring, 52°; summer, 70.6°; autumn, 53°, and winter, 32.3° F. The highest summer temperature observed during the past three years has been 88° F. in the shade. The region is quite free from malarial and miasmatic influences. The springs are surrounded by a tract of eighteen acres of the primeval oak forest, which furnishes a delightful shade in the summer. The accommodations for visitors are as yet somewhat limited, but a commodious hotel is in contemplation for the near future. Two good hotels and numerous excellent boarding-houses will be found in Wytheville. The springs are three in number, two lithia and one chalybeate. The summer temperature of the water of the two lithia springs is respectively 53° and 54° F., and the chalybeate 56° F. The following analysis of two of the springs is furnished by Dr. George L. Nye, the resident physician:

NYE LITHIA SPRING, NO. 1.

Alkaline-lithic.

(W. L. Dudley, Vanderbilt University, Analyst.)

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	10.63
Lithium carbonate	6.41
Iron and alumina oxide	0.31
Silicic acid	1.19
Total	18.54

NYE CHALYBEATE SPRING.

Alkaline-chalybeate. Lithic-calcic.

(J. L. Jarman, of Emory and Henry College, Analyst.)

One U. S. gallon contains:

Solids.	Grains.
Potassium carbonate	0.01
Sodium carbonate	0.81
Lithium carbonate	1.89
Calcium carbonate	11.60
Magnesium carbonate	2.35
Iron and alumina oxide	1.33
Silicic acid	0.66
Total	18.65

Rating the lithium in these analyses as the bicarbonate it would amount respectively to 11.77 and 3.48 grs. per gallon.

The waters have long been highly prized in the treatment of a variety of disorders. Dr. Nye presents numerous reports of cases from competent physicians illustrating their beneficial influence in diabetes and other urinary disorders. The action of the water in cases of dyspepsia and intestinal affections is also very advantageous. The chalybeate water is much resorted to in the treatment of menstrual and uterine disorders consequent upon anæmia.

POWHATAN LITHIA AND ALUM SPRINGS,

Powhatan County.

Post-office, Tobaccoville. Access: From Richmond *via* Farmville and Powhatan R. R. to Tobaccoville Station, forty-eight miles west, thence three-quarters of a mile by private conveyance to springs.

These springs are two in number, one known as the Lithia, the other as the Alum Spring. They yield about 500 gallons of water per day. A quantitative analysis of the lithia water by Dr. W. H. Taylor, State Chemist at Richmond, showed the presence of lime, magnesia, soda, lithia, potash, iron, silica, sulphuric acid, carbonic acid, and chlorine. The alum water was analyzed at the Smithsonian Institution and found to contain about the same ingredients, except that the lithia was replaced by alum. The water is sold to some extent, but the property has never been much developed and no hotel accommodations have been provided.

RAWLEY SPRINGS,

Rockingham County.

Post-office, Rawley Springs. Hotel. Access *via* Baltimore and Ohio R. R. to Harrisonburg, thence a two-hours' drive over a macadamized turnpike to springs.

This is one of the famous old Virginia mountain resorts, and it unites many of the best features of a summer resting-place. The elevation is 2000 feet above the sea-level, and the climate peculiarly dry and equable. The surrounding scenery is wild and rugged, but at the same time picturesquely attractive. The hotel at the springs is a comfortable and handsomely furnished building containing 77 rooms, with a dining-room capacity of 150 guests. It is well supplied with modern comforts and conveniences and facilities for amusement. An excellent band of music is in attendance during the regular season. The springs here are three in number. The water of each fountain seems to possess the same general characteristics. It is without odor and possesses a strongly marked chalybeate taste. It exhibits a faintly acid odor from the presence of carbonic acid. This disappears as the paper dries. The water is perfectly clear and transparent as it flows from the earth, but on exposure to the air it soon begins to deposit a rust-colored precipitate of the oxide of iron. The temperature of the main spring is about 51° F. Analysis by Prof. J. W. Mallet resulted as follows:

RAWLEY SPRINGS.

Light Carbonated-chalybeate.

One U. S. gallon contains: Solids.	Grains.
Iron protoxide	1.09
Manganese protoxide	0.01
Alumina	0.04
Magnesia	0.03
Lime	0.29
Lithia	Trace.
Soda	0.25
Potash	0.05
Ammonia	Trace.
Sulphuric acid	0.04
Chlorine	0.02
Silicic acid	0.06
Carbonic acid (combined)	1.26
Organic matter	0.03
Total	3.17
Gases.	Cubic inches.
Carbonic acid	6.03
Oxygen	1.72
Nitrogen	3.43

The combinations have not been worked out in this analysis, but it will readily be seen that iron is the chief ingredient. The qualities of the water are improved by the presence of carbonic acid. It is a very useful light carbonated chalybeate water, and has an extensive sale even at distant points.

ROANOKE RED SULPHUR SPRINGS,

Roanoke County.

Post-office, Roanoke Red Sulphur Springs. Hotel and cottages. Access *via* Norfolk and Western R. R. to Salem, thence nine miles north to springs.

This resort is located under the shadow of the outlying ranges of the Alleghanies, twelve miles from Roanoke City. The manifold attractions of the Virginia mountain region find here a faithful exemplification. The high and dry location, the pure, fresh air, and the unsurpassable mountain scenery unite to form a most delightful summer health resort. In the hotel will be found all the comforts and attractions which go to render a stay at a watering-place enjoyable. A band of music is maintained from May to October. Fine trout fishing and excellent hunting ranges will be found in the neighborhood. Among the numerous points of interest within a short distance of the springs are the famous Murder Hole, McAfee's Knob, and the celebrated Flowing Spring. This spring flows twice each day for about an hour each time, and then dries up as suddenly as it commences. These alternating outflowings and remissions were once supposed to correspond to the rise and fall of the tides, but as the location was found to be 2000 feet above the sea-level, this theory was speedily abandoned. The spring is now held to form a kind of siphon-like outlet to a large body of water accumulating in a subterranean reservoir under the near-by mountain. [It is probably a variety of geyser, the phenomena of which have been explained in a preceding chapter.]

The Roanoke Red Sulphur waters have been examined by Prof. M. B. Hardin with results as follows:

ROANOKE RED SULPHUR SPRINGS.

Alkaline-carbonated. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	6.54
Magnesium carbonate	5.83
Lithium carbonate	0.02
Manganese carbonate	0.02
Iron carbonate	0.06
Copper carbonate	Trace.
Sodium chloride	0.24
Ammonium chloride	0.02
Calcium chloride	0.03
Lead sulphite	Trace.
Barium sulphate	"
Strontium sulphate	1.71
Calcium sulphate	2.19
Sodium sulphate	3.04
Potassium sulphate	0.33
Sodium hyposulphite	0.03
Ammonium nitrate	0.05
Alumina	Trace.
Silica	0.83
Organic matter	0.76
Arsenic	Trace.
Total	21.70
Carbonic anhydride combined with mono-carbonates to form bicarbonates	5.96
Total	27.66

Gases.	Cubic inches.
Carbonic acid	12.40
Sulphureted hydrogen	2.44

These waters are useful in those classes of cases requiring a fairly concentrated sulphur water. They possess alterative, diuretic, and tonic properties. It will be observed that they contain an unusually large proportion of strontium, an element whose therapeutic properties are not as yet fully understood (*vide* Strontium in the chapter on Mineral Ingredients). The following analysis of the chalybeate spring at this resort was made by Dr. H. Froehling :

CHALYBEATE SPRING (ROANOKE RED SULPHUR SPRINGS).

Alkaline-chalybeate. Carbonated.

One U. S. gallon contains :

Solids.	Grains.
Calcium carbonate	0.45
Magnesium carbonate	0.95
Iron carbonate (of protoxide)	2.09
Manganese carbonate	0.09
Sodium carbonate	0.44
Ammonium carbonate	Traces.
Sodium chloride	0.27
Potassium sulphate	0.20
Sodium sulphate	0.08
Aluminium sulphate	0.05
Aluminium phosphate	0.02
Silica	0.50
Organic matter	0.06
Total	5.20
Carbonic acid to form bicarbonates	2.00
Total	7.20

Free carbonic acid gas, 12.30 cubic inches.

This water is very useful in anæmia and debilitated states of the system. The Roanoke Sulphur Springs are much resorted to in the treatment of chronic bronchial, pulmonary, and throat affections. The waters of the spring, combined with the wholesome atmospheric conditions of the neighborhood, are believed to be almost a specific for hay-fever. The proprietor offers numerous letters from responsible medical men illustrating the curative value of a sojourn here in this and other bronchial and pulmonary troubles when not too far advanced.

*ROCKBRIDGE ALUM SPRINGS,

ROCKBRIDGE COUNTY.

Post-office, Rockbridge Alum Springs. Hotel and cottages. Access *via* Chesapeake and Ohio R. R. to Goshen, thence by stage to springs.

These springs are located in a glen-like nook formed by the spurs of the North and Mill Mountains, and break forth from a mass of slate rock at the base of the ridge. This slate contains large quantities of alumina and the salts of iron, and the springs are formed by the percolation of water through this mass. Four different reservoirs have been formed, numbered respectively No. 1, No. 2, No. 3, and No. 4. The immediate surroundings of this resort are very attractive. The hotel and cottages encircle a lawn embowered with trees, and sociability and amusement add their charms. The numerous springs here are characterized by the presence of alum in large quantities, iron, and sulphuric acid. They vary somewhat in their analyses, the proportion of alum ranging from 6.88 grammes per gallon in Spring No. 6, to 81.05 grammes in Spring No. 7. Different chemists have also arrived at different results in analyses of the same spring. We present the following analysis by Prof. M. B. Hardin of Spring No. 2, which is fairly representative of the group:

SPRING NO. 2 (ROCKBRIDGE ALUM SPRINGS).

Acid-chalybeate. Aluminous.

One U. S. gallon contains:

Solids.	Grains.
Sodium sulphate	0.03
Calcium sulphate	3.23
Lithium sulphate	0.02
Magnesium sulphate	5.61
Potassium sulphate	0.41
Aluminium sulphate	42.61
Manganesium sulphate	0.09
Iron persulphate	1.95
Nickel sulphate	0.14
Cobalt sulphate	0.02
Zinc sulphate	0.39
Lead sulphate	Trace.
Ammonium nitrate	"
Calcium phosphate	0.17
Sodium chloride	0.11
Calcium fluoride	Trace.
Antimony	"
Copper	0.04
Arsenic	Trace.
Silica	3.70
Sulphuric acid	3.83
Organic matter	Trace.
Total	62.35

Gases.	Cubic inches.
Oxygen	1.49
Nitrogen	3.98
Carbonic acid	10.89

These have long been regarded as among the best alum waters known. They are clear and odorless, but possess a strongly astringent and styptic taste. Their temperature ranges from 50° to 56° F. They are of undoubted efficacy in cases requiring an astringent chalybeate. They have proved valuable in atonic and catarrhal states of the mucous membrane, chronic diarrhœa, leucorrhœa, pharyngitis, rhinitis, etc. They are very useful locally in scrofulous ulcers and other slow-healing similar conditions. It is said that severe syphilitic eruptions are often speedily relieved by the internal and external use of the water without the aid of other medication. The waters sometimes prove purgative in large doses, and are always diuretic in doses of one-quarter to one-half of a small tumblerful taken six, eight, ten, or twelve times a day. The effects of the water often last far beyond the period during which they are taken.

ROCK ENON SPRINGS,

FREDERICK COUNTY.

Post-office, Rock Enon Springs. Hotel. Access *via* Valley Branch of the Baltimore and Ohio R. R. to Winchester, thence by coach over picturesque mountain road sixteen and one-half miles to springs Time from Washington, six and one-half hours.

This resort is located in the great North Mountains. It is surrounded by the primeval forest, and nestles under the shadow of a majestic peak in a romantic gorge, through which flows Laurel Brook, a beautiful stream supplied by the mountain springs, winding about the hotel and its attractive lawn. The locality is free from swamp lands and malaria. The hotel has a location of 1200 feet above tide-water. This is a model caravansary, and the visitor may feel assured that every device for his comfort, health, and amusement has been arranged for by the thoughtful proprietor. The scenery in the neighborhood is exceptionally fine, and the rambler will find a host of attractions to engage his attention. A stroll of three miles takes the tourist to Anderson's View, where a panorama of mountain and valley of surpassing loveliness unfolds itself. A climb to the Pinnacle, the highest point of the great North Mountains, gives the visitor a magnificent view, including a portion of four States. Close to the hotel are three mineral springs, which have been found to possess well-marked medicinal properties. The chalybeate spring was analyzed by Professors Gale and New, of the Smithsonian Institution, Washington, who found it to contain the following constituents:

CHALYBEATE SPRING (ROCK ENON SPRINGS).

Sulphated-saline. Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	1.21
Calcium carbonate	5.13
Calcium sulphate	3.56
Magnesium sulphate	12.89
Magnesium chloride	1.12
Iron oxide	14.25
Manganesium oxide	1.05
Alumina	0.80
Silica	0.42
Total	40.43

This water resembles that of the Pyrmont Spring in Waldeck, Germany. It is a strong chalybeate, and possesses aperient and diuretic properties.

The Alkaline Spring. This water is of the alkaline-carbonated variety. A qualitative analysis by Prof. Lupton, late of the University of Virginia, showed the presence of potassium and magnesium carbonate, sodium chloride, calcium sulphate and carbonate, silica, and carbonic, sulphuric, and hydrochloric acids. The water is antacid, diuretic, and aperient, and is used in affections of the kidney and urinary passages, dyspepsia, gout, and catarrhal affections.

The Old Capper Spring. This spring once gave its name to the resort, and it is styled Capper's Springs in the older books. It has been in use for more than a century. The water is described as being efficacious in rheumatism, diseases of the skin, and certain of the intestinal worms. When applied to eruptions on the skin, to venomous bites, cuts, or bruises they heal very quickly, and when used for bathing or washing it leaves the skin clear and soft.

White and blue sulphur springs of excellent quality are also found in the neighborhood. The following table shows the mean temperature at Rock Enon for July and August during the past ten years: July, 7 A.M., 66° F.; 12 M., 77°; 3 P.M., 78°; 6 P.M., 75°, and 10 P.M., 66.25. For August at the same hours the record was 64.5°, 74.5°, 76°, 73°, and 66° F.

SEVEN SPRINGS,

Washington County.

These springs are located two miles from the Glade Springs Depot, on the Norfolk and Western R. R. They have been known for many years, but no accommodations have ever as yet been provided for visitors. The waters are used commercially in the form of Seven Springs Iron and Alum Mass, an evaporated residue. An analysis of this mass by Prof. J. W. Mallet, of the University of Virginia, showed the presence of a large proportion of aluminium sulphate and iron persulphate, beside a considerable quantity of magnesium and calcium sulphate, and numerous other ingredients in smaller proportion. This substance is highly recommended as a general tonic and reconstructive, and is said to possess special merits in such affections as cholera morbus and dysentery, and in various hepatic and intestinal disorders.

SWEET CHALYBEATE SPRINGS,

Alleghany County.

Post-office, Sweet Chalybeate Springs. Access *via* Chesapeake and Ohio Railroad to Alleghany Station, thence a drive of nine miles to the springs.

These well-known springs are ensconced in a lovely valley on the backbone of the Alleghany Mountains, at an elevation of 3000 feet above the sea. The location is in the midst of the "Springs Region," and whatever may be said regarding the salubrity of climate, the charm of scenery, and the general attractiveness of the Old Dominion mountain resorts, may be fittingly applied to these springs and their environments Among the more immediate desirable features may be mentioned a comfortable and tidy hotel, a commodious bathing establishment with facilities for hot and cold mineral water baths, enclosed pools for plunge bathing, etc. The section around abounds in deer and other mountain game, while the streams afford excellent fishing. The springs, formerly known as the Red Sweet Springs, are situated in one of the most beautiful valleys of Virginia, but they do not differ essentially in chemical composition, unless it be the upper one, which is somewhat similar to the Old Sweet Springs, one mile above. The combined flow of the four springs is about 48,000 gallons per hour. The following analysis was made by Prof. W. B. Rogers :

SWEET CHALYBEATE SPRINGS (RED SPRING).

Calcic-chalybeate.

One U. S. gallon contains :

Solids.	Grains.
Magnesium carbonate	2.70
Sodium sulphate	3.23
Calcium sulphate	32.88
Magnesium sulphate	7.18
Sodium chloride	0.09
Magnesium chloride	1.57
Calcium chloride	0.02
Iron sesquioxide	0.73
Total	48.40

Gases.	Cubic inches.
Carbonic acid	106.49
Sulphureted hydrogen	Trace.
Oxygen	0.46
Nitrogen	0.59

A second analysis by Prof. Rowelle, shows four grains of iron (in combination) to the gallon.

This is a very good calcic-chalybeate water. Its taste is somewhat sweet, but ferruginous. Its temperature at the fountain is about 75° F. The water is beneficially employed in anæmia, chlorosis, leucorrhœa, and other conditions indicating an impoverished state of the blood. It has also proved efficacious in neuralgia and gastralgia.

TALLEY'S SPRINGS,

MECKLENBURG COUNTY.

Post-office, Palmer's Springs. Talley's Springs are located seventy-five miles southeast of Petersburg, and within eight miles of the Atlantic and Danville R. R., on the north, and eleven miles of the Seaboard Air-line, on the south. The situation is in a beautiful valley, the surface being clothed in a magnificent growth of original oak. The country is moderately hilly in character, and the climate very genial and salubrious. The springs have never been developed, but the waters have been resorted to by residents of the district for many years, and numerous cases are cited which illustrate their beneficial effects. A partial analysis has shown the presence of lithia, sulphur, and iron. A strong odor of sulphureted hydrogen pervades the neighborhood. The water is said to have a wonderful preservative power. We are informed by Mr. G. W. Davis, the owner, that a small green log which has lain in the spring between thirty and forty years is still perfectly sound. It is stated that the advantages of these strong waters and the many attractive features of the neighborhood will soon be turned to good effect and a desirable summer resort established. Palmer's Springs, which also possess a local reputation, are two miles away.

WASHINGTON SPRINGS,

Washington County.

Post-office, Glade Springs. Hotel and cottages. Access *via* Norfolk and Western R. R. to Glade Springs Depot; thence two miles by hack or carriage to springs.

This resort is ensconced in a delightful location high among the hills, at an altitude of 2250 feet above the sea-level. The situation is opposite to and faces the White Top Mountain, one of the highest peaks in Virginia. Close by are the Chilhowee Sulphur Springs, Seven Springs, and Emory and Henry College. An excellent hotel, with various means for the comfort and amusement of the guests, is maintained. The springs are seven in number, and have an average flow of 30 gallons per hour. The water has a temperature of 51° F. We present analyses of the "Sulphur" Springs and the "Magnesia Soda-iron" Spring, by W. H. Seamon, analyst, of Crozet, Va.:

SULPHUR SPRING (WASHINGTON SPRINGS).

Light Alkaline-calcic. Sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Iron carbonate	0.52
Calcium carbonate	2.79
Potassium carbonate	0.11
Sodium carbonate	0.29
Calcium sulphate	6.47
Strontium sulphate	Trace.
Calcium phosphate	0.14
Sodium chloride	0.09
Arsenic chloride	Trace.
Hydrogen sulphide	Present.
Total	10.41

MAGNESIA-SODA IRON SPRING (WASHINGTON SPRINGS).

Alkaline-calcic. Chalybeate.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	0.10
Magnesium sulphate	4.04
Strontium sulphate	0.38
Sodium sulphate	3.97
Aluminium sulphate	Trace.
Iron carbonate	1.95
Manganesium carbonate	Trace.
Calcium carbonate	13.66
Sodium chloride	0.34
Potassium chloride	0.24
Phosphoric acid	Traces.
Silica	2.07
Organic matter	1.03
Total	27.78

These waters have a useful application in debilitated states, especially when attended by intestinal torpor. They have rendered good service in anæmia and general debility.

YELLOW SULPHUR SPRINGS,

MONTGOMERY COUNTY.

Post-office, Yellow Sulphur Springs. Hotels and cottages. Access *via* Norfolk and Western R. R. to Christiansburg Depot; thence three and one-half miles by stage to springs.

This resort is located near the summit of the Alleghany Mountains, at an elevation of 2000 feet above the sea. We find here the usual beautiful scenery and charming climate characteristic of the Alleghany resorts. Four miles north of the springs is the village of Blacksburg, the location of the Virginia Agricultural and Mechanical College and the State Experimental Station. The Montgomery White Sulphur Springs are also within a distance of only four miles. The Alleghany Springs are fifteen miles, and the wonderful Mountain Lake and Bald Knob eighteen miles distant. A large new hotel, having sixty-four bed-chambers, a handsome ball-room, a large and well-ventilated dining-room, numerous bathrooms, etc., are among the recent improvements. The lawn and pleasure-grounds are shaded by magnificent forest trees, whose tops are even with the summits of the mountains, and make a delightful and luxurious shelter in warm weather. The Yellow Sulphur Spring yields 180 gallons of water per hour, having a temperature of 55° F. The water is transparent and very palatable. Baths of this water are always to be had at any desired temperature.

The following analysis of the water is taken from the United States Dispensatory for 1880, p. 1832:

YELLOW SULPHUR SPRINGS.

Sulphated-saline. Calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium carbonate	8.64
Magnesium carbonate	1.38
Iron carbonate	0.62
Free carbonic acid	4.68
Calcium sulphate	63.30
Magnesium sulphate	21.09
Aluminium sulphate	3.18
Potassium sulphate	0.11
Sodium sulphate	0,75
Iron protoxide	Traces.
Calcium phosphate	0.01
Magnesium phosphate	0.01
Potassium chloride	0.09
Sodium chloride	0.08
Organic matter	3.73
Total	107.67

The title to the designation "sulphur" water is not made clear by this analysis, yet it shows a valuable combination of mineral ingredients. The water should possess antacid, diuretic, and laxative properties. It contains sufficient iron to give it a tonic influence and enough free carbonic acid to impart a pleasant sparkle and to endow it with a grateful sedative action on the stomach. The water has been found on continued use to brace up and give tone to the muscular system, to allay chronic and subacute inflammations of the gastro-intestinal mucous membrane, thus regulating the secretory function, tranquillizing the nervous system, and tending to promote sound and refreshing sleep. It is highly recommended in chronic disorders of the female generative organs, especially in amenorrhœa, dysmenorrhœa of certain forms, and in leucorrhœa. It also acts as a valuable restorative in general debility and in convalescence from acute prostrating diseases. The baths are recommended for rheumatism and chronic squamous skin affections.

There are numerous additional mineral springs in the Old Dominion. Some of them have fallen into disuse, and are no longer resorted to. No doubt there are several still open to the public which are not included in the above list. Assiduous personal inquiry and correspondence, however, have failed to develop any trustworthy recent information concerning them, and they have consequently been omitted. The following are the best known of these springs which have been used for medicinal purposes:

Buckingham White Sulphur Springs, near Buckingham Courthouse, Buckingham County.

Cedar Bluff Sulphur Springs, Cedar Bluff, Tazewell County.

Clifton Springs, near Clifton Forge, Alleghany County.

Coyner's Sulphur Springs, Botetourt County.

Huguenot Springs, seventeen miles from Richmond, Powhatan County.

Jordan Alum Springs, near Rockbridge Alum Springs, Rockbridge County.

Orkney Springs, Orkney Springs, Shenandoah County.

Rockbridge Baths, Rockbridge Baths, Rockbridge County.

Rockingham Virginia Springs, near McGaheysville, Rockingham County.

Sharon Springs, Sharon Springs, Bland County.

Shenandoah Alum Springs, Shenandoah Alum Springs, Shenandoah County.

Stribling or Augusta Springs, Striblings Springs, Augusta County.

Variety Springs, near Pond Gap, Augusta County.

Wallawhatoola Alum Springs, near Millboro Depot, Bath County.

Wolf-trap Lithia Springs (Well), Wolf-trap, Halifax County.

The following springs reported sales of water to the United States Geological Survey in 1896:

Chase City Mineral Springs, Chase City, Mecklenburg County.

Cove Lithia Springs, near Wytheville, Wythe County.

Lake Como Lithia Springs, Henrico County.

Osceola Springs, near Pleasant Valley, Rockingham County.

Otterburn Magnesia and Lithia Springs, Amelia, Amelia County.

Paconian Springs, Loudoun County.

Pine Mountain Springs, Washington County.

Sea Wright Magnesia Lithia Spring, Staunton, Augusta County.

Swineford Arsenic Lithia Spring, Osceola County.

Virginia Magnesian Lithia Springs, Staunton, Augusta County.

Virginia Waukesha Lithia Springs, Staunton, Augusta County.

WASHINGTON.

The new State of Washington extends from 45° 33′ to 49° north latitude, and from 117° to 124° 41′ west longitude. The State is divided by the Cascade Mountains into two unequal sections which have very different climatic and physical characteristics. The climate of the western section is very mild, on account of the warm oceanic current from Japan, which flows south along the coast. The moisture-bearing winds which move inland from the coast are chilled against the Cascade Mountains, and cause the western section of the State to have a very heavy rainfall (about 53 inches annually), which is quite evenly distributed throughout the year. The summers are cool and pleasant and the winters mild; flowers bloom in the open air every month in the year, and the nights are always cool and refreshing. The climate in the western section is quite similar to that of Scotland. That of the eastern section is remarkable for clearness and brightness; it is hot and dry in the summer, and the winters are brief, but severe. The climate of this portion is tempered by a remarkably balmy wind, known as the Chinook wind, coming over the mountains from the great Japan current of the Pacific. In the summer it is a cool wind, tempering the heat, while in the winter it is a warm wind, before which snow and ice quickly disappear. The Cascade Range traverses the State from north to south, with an elevation of from 3000 to 14,000 feet, Mt. Ranier, the highest peak, reaching an altitude of 14,445 feet. The Coast Range is a spur from the Cascades, its highest elevation being Mt. Olympus, 8000 feet. These mountains are generally covered with immense forests of fir, spruce, cedar, and pine. The Columbia River, noted for its grand and impressive scenery and the number of its cataracts and rapids, enters the State from British Columbia, traverses its entire length, and forms two-thirds of its southern boundary. With its numerous tributaries it drains nearly the entire State. The principal feature of the coast line is Puget Sound, one of the most beautiful sheets of salt water in the world. The total area of the sound is about 2000 square miles, with a shore-line of 1600 miles. The water is very deep, and in some places it is said that ocean steamships of the deepest draught could approach the banks and tie up to the trees as to a wharf. The sound has innumerable bays, coves, inlets, and channels, branching off from the main body, altogether forming a collection of harbors unsurpassed in the world, and, with the deep green setting of the dense forest-growth on the shores, presenting a tableau of surpassing loveliness. The mean annual temperature of Washington is 50.81° F.

The rate of mortality, as computed from the United States census of 1890, is 7.71 per 1000 of inhabitants. The death-rate from consumption is 0.79 per 1000 of population.

Our knowledge of the mineral springs of Washington is so far not extensive. Walton mentions but one locality used as a resort. Peale's list gives two spring resorts, while our own examination of all available literature on the subject, supplemented by numerous inquiries addressed to every section of the State, has added but one more to the list. There are a number of undeveloped spring localities, the United States Geological Reports presenting a list of twelve. As far as known, the spring waters of the State are chiefly of the alkaline-sodic variety. There are also several thermal springs.

CASCADE WARM SPRINGS,

Skamania County.

Post-office, Cascades. Hotel. These springs are located near the Cascades of the Columbia River. Two steamers from Portland

land daily, except Sunday, within one mile of the resort. The springs are four in number, and have a temperature of 96° F. They are of the alkaline-saline-sulphureted type. The water is clear and refreshing to the palate when cooled. It is well adapted for club and bar purposes, and is said to be valuable in dyspepsia, rheumatism, and general debility. A hotel is maintained at the springs, and visitors may also camp out in the neighborhood if they so choose. The water is used commercially, and will be found on sale in Portland.

MEDICAL LAKE,

SPOKANE COUNTY.

Post-office, Medical Lake. Hotels. Access *via* Central Washington branch of the Northern Pacific R. R. to Cheney; thence eight miles northwest to lake.

This remarkable body of water is about one and one-half miles in length by one-half mile in width. It is located on an elevated plateau, and is surrounded by an evergreen border of pine, fir, and tamarack. There are four good hotels on the lake, commodious bath-houses, splendid drives, delightful camping places, and an abundance of fish in the neighboring lakes. The East Washington Hospital for the Insane is also located here. The waters of the Medical Lake were analyzed by G. A. Mariner in 1882, with the following result:

WASHINGTON MEDICAL LAKE.

Alkaline-saline. Sodic.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	63.54
Lithium	Trace.
Magnesium carbonate	0.23
Iron carbonate	0.53
Calcium carbonate	0.18
Sodium chloride	16.37
Potassium chloride	9.24
Aluminium oxide	0.18
Sodium metasilicate	10.63
Potassium sulphate	Trace
Sodium biborate	"
Organic matter	0.55
Total	101.45

The water has excellent properties as an antacid, laxative, and diuretic. It is used commercially. The evaporated salts resulting from distillation are also packed and shipped to different sections of the country. It is said that an excellent quality of soap is prepared from the residue.

SODA SPRINGS,

Klickitat County.

We are informed by Postmaster Cleaves, of Blockhouse, that a valuable mud spring is located within a short distance of his residence. The water has thrown up a mound of mud fifty feet in diameter. The water is believed to be strongly impregnated with the bicarbonate of soda as well as with iron, sulphur, and other ingredients, and it is confidently stated that the spring would well repay proper development. The location is in a charming section, seven miles from Goldendale and nineteen miles from Grant.

WETEMIS MINERAL SPRINGS,

Klickitat County.

Post-office, Blockhouse. Access: From The Dalles, Oregon, thirty-fives miles by wagon-road; also from Goldendale, Washington, eighteen miles distant, by private conveyance.

These springs are new to the public, and no hotels or other accommodations for visitors have yet been provided. Those who visit them during the season, from May 1st to October 15th, are content to enjoy the pleasures of camp life, as excellent grounds for this purpose are at hand. The elevation of the location is 500 or 600 feet above the sea-level, but only a few feet above the Klickitat River, which at this point flows through a grand and picturesque canyon, a thousand feet below the level of the surrounding country. From the brink of the canyon on either side stretches a rolling plateau covered with magnificent forests of pine and fir. A few miles to the southward lies the wheat-growing region of the Klickitat River, while less than thirty miles north, Mt. Adams, the second highest peak of the Cascade Range, raises its lofty summit to an elevation of 12,424 feet. The canyon of the Klickitat shelters the springs from the cold winds, while during the summer months clear, warm weather prevails, with occasional rains. The temperature seldom falls lower than —10° or —12° F., while during some winters it does not even reach the zero point. There are three large springs here and several smaller ones, but the water has never yet been analyzed. We are informed that most persons suffering from rheumatism and diseases of the stomach who have visited the springs have been much benefited by the water, and some of them apparently cured. Cases of phthisis do well in the neighborhood. Fine hunting and fishing may be enjoyed in the vicinity. It is probable that the spring will soon be developed.

OTHER SPRINGS IN WASHINGTON.

The following springs seem worthy of mention:

Brackett Spring, Edmonds, Snohomish County.

Chalybeate Springs, Clallam County.
Denny Springs, King County.
Pinkham Mineral Spring, or Well, Lake Union, King County.
Saline Springs, east end of Rattlesnake Mountains, Yakima County.
Sulphur Lake, east of Palouse Junction, Whitman County.
Sulphur Spring, Garfield County.
Thermal Wells, Ainsworth, Whitman County.

WEST VIRGINIA.

West Virginia extends from 37° 6′ to 39° 37′ north latitude, and from 77° 43′ to 83° 33′ west longitude. The entire surface of the State is mountainous or hilly, being comprised within the region known as the Cumberland or Alleghany plateau. The highest land in the State is upon the eastern and southern boundary, where the plateau in many places reaches elevations exceeding 4000 feet. Thence the country has a general slope to the northwest, and is lowest along the Ohio, where the elevation is but 600 or 800 feet. This plateau has been subjected to stream erosion until it has become a network of narrow, crooked ridges, with deep gorges or contracted valleys. The height of the ridges and the depth of the valleys, together with the ruggedness of the country, diminish toward the northwest, until near the Ohio the hills become rounded and softened in outline, and the valleys are broad and fertile. Although the general slope of the State is toward the northwest, the Potomac, which flows southeasterly to the Atlantic Ocean, has cut its way far back into the plateau, and drains, by means of numerous long branches, the northeastern quarter of the State. The remainder of the State is drained to the Ohio by means of several large branches which flow in a general northwesterly direction. The climate is nowhere severe, although owing to the range in elevation there is a considerable range of temperature. The mean annual temperature ranges from 55° to 56° F., being highest in the neighborhood of the Ohio, in the western part of the State, and lowest upon the high mountains in the eastern and notheastern portion. The maximum is rarely above 95° F. in any portion of the State, while the minimum occasionally reaches 10° in the more mountainous sections. The rainfall may be given broadly at between 40 and 50 inches annually. The mortality-rate of the State, according to the census of 1890, was 10.85 per 1000 of population. The phthisical death-rate is 1.50 per 1000 of population.

West Virginia is noted for possessing one of the oldest and most celebrated mineral spring resorts in the United States—the Greenbrier White Sulphur Springs. There are also a number of other valuable and widely known springs. Most of them may be classified as saline-calcic, or alkaline-calcic, and a fair proportion are also sulphureted.

Two localities have waters which may be ranked as thermal, viz., the Berkeley Springs, with a temperature of 75° F., and the Sweet Springs, with 79° F. The following account is obtained almost entirely from a recent personal investigation.

ADDISON SULPHUR SPRINGS,

WEBSTER COUNTY.

Post-office, Addison. Hotels and boarding-houses. Access *via* West Virginia and Pittsburg R. R. to Cowen; thence by stage twelve or fifteen miles to springs. A railroad now under construction from a point on the former line will soon be completed to the springs.

The town of Addison is picturesquely located on the banks of the clear and beautiful Elk River. The situation is about 1400 feet above the sea-level, and the surrounding country of a mountainous character with a variety of pleasing scenery. The town has nine small hotels, but the accommodations are not sufficient to provide for the summer visitors. A commodious modern hotel will soon be erected. There are two natural springs and one bored well, all producing the same variety of water. We are indebted to Dr. George B. Simpson, proprietor of the Webster Springs Sanitarium, in the neighborhood, for the following partial analysis :

ADDISON SULPHUR SPRINGS.

Muriated-saline-calcic.

One U. S. gallon contains :

Solids.	Grains.
Calcium carbonate, Magnesium carbonate,	13.17
Calcium sulphate, Magnesium sulphate,	19.36
Sodium chloride	377.32
Iron oxide	Traces.
Volatile and organic matter	57.45
Total	467.30

Mr. R. H. Townsend, of Addison, informs us that the water is also heavily impregnated with sulphureted hydrogen. Its temperature is 57° F.

This water is evidently of a fairly strong saline-sulphureted type, and it should possess the virtues of waters of this class. It has a strong salty flavor, but most persons find it quite palatable. Statements agree that it possesses undoubted value in disorders of the alimentary tract and liver. It is especially beneficial in cases of chronic constipation.

BARGER'S SPRINGS,

SUMMERS COUNTY.

Post-office, Talcott. Private boarding-house. Access *via* Chesapeake and Ohio R. R. to Talcott; thence a drive of three miles to the springs.

These springs are located in a picturesque, broken region, marked by cragged cliffs, and narrow shaded glens, with numerous rapid mountain streams dashing through them. Two hundreds yards distant is the romantic Greenbrier River, a stream noted as well for its charm of scenery as for the enticements it offers to anglers. The springs have not been much improved as yet, and the only stopping place for visitors is a boarding-house with a limited capacity. The water has not been analyzed, but it is evidently thoroughly charged with sulphureted hydrogen. Residents of the locality resort to it for the treatment of atonic dyspepsia. It is also beneficial in chronic rheumatism, and a number of cases of cystitis of long standing are said to have been cured by its use. The water also possesses tonic properties, and is a useful adjunct in debilitated states. Its temperature is 58° F.

BERKELEY SPRINGS,

MORGAN COUNTY.

Post-office, Berkeley Springs. Hotel. Access *via* Baltimore and Ohio R. R. to Hancock Station; thence by Berkeley Springs and Potomac R. R. directly to springs. Trains on the latter road make close connection with all day trains during the season. The location is six miles south southwest of Potomac River and Hancock Station.

These historic old springs are situated in a narrow valley, about 800 feet above the sea-level, and issue from the base of a steep ridge, rising at this point about 450 feet above the valley. Tradition has it that the waters here were well known to the aborigines, who, although generally at war among themselves, established a standing truce around the springs, that all might avail themselves of their potent virtues. They have been known and used by the whites since 1730, and it is said that they were visited by George Washington while employed with a surveying expedition in 1748.[1] The Father of his Country was so appreciative of the many attractions of the neighborhood that he afterward acquired property immediately adjacent to the principal spring, on which he erected two "comfortable and convenient houses." General Horatio Gates, Charles Carroll of Carrollton, and other well-known figures of Revolutionary days, were also represented among the owners in the old town established in 1776. The location of Berkeley is in a beautiful mountain region, covered for the most part by primeval forests, with a botanical undergrowth peculiarly rich, varied, and interesting. The scenery is wild and romantic, and the country is threaded with pleasant walks and drives in all directions. The air is pure and wholesome, and the heat during the summer months is rarely oppressive. Among the attractive and interesting features of the springs and vicinity are: The grove, consisting of five or six acres of beautifully wooded and improved ground adjacent to the springs; the observatory at Fairview; Lovers' Leap, and Cacapon Rock. The streams in the neighborhood are well stocked with fine game-fish, chief among them being the black bass. The forests also abound in the larger game, including deer, wild turkeys, and pheasants, which afford good sport after September 1st. The spacious hotel at Berkeley, having a capacity for 500 guests, has recently changed hands, and has been entirely renovated and refitted. It is thoroughly supplied with all the accessories for comfort and amusement which go to make life at a watering-place enjoyable. Water from the spring is supplied to each floor. All varieties of hot, warm, and cold baths are at hand, and two large plunge and swimming pools have been constructed. The springs discharge from five principal sources, all within a radius of one hundred yards. The water is clear, sparkling, and tasteless. Its temperature is 75° F., which does not vary, and the flow about 120,000 gallons per hour. The following analysis was made by Prof. A. A. Hayes, of Massachusetts, in 1855:

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[1] Sparks' Life of Washington, vol. ii., p. 417.

BERKELEY SPRINGS.

Light Calcic-chalybeate.

One U. S. gallon contains: Solids.	Grains.
Calcium carbonate	5.00
Calcium crenate	3.64
Iron crenate	0.08
Sodium chloride	0.89
Calcium silicate	0.64
Magnesium sulphate	0.36
Calcium chloride	0.21
Loss	0.06
Total	10.88

The gaseous contents are one-twenty-eighth of the volume of the water, and composed as follows in 100 parts:

Carbonic acid	19.00
Oxygen	16.60
Nitrogen	64.30
Total	99.90

An analysis made by J. H. Dickson, chemist, of Pittsburg, Pa., in 1892, shows a total of 13.49 grains per United States gallon.

The qualitative results are practically identical with those above shown. The baths at Berkeley have been celebrated for many years in the treatment of gout, sciatica, and rheumatism. The internal use of the water is said to produce excellent results in chronic dyspepsia and diarrhœa. Many Virginia families take their children to this resort on account of its reputation as a restorer in rhachitis and general feebleness and its value in summer complaints during the period of dentition. The baths possess a marked cosmetic effect, rendering the skin soft, fresh, and elastic, and aiding in the removal of tans and freckles. There are also in close proximity two strong chalybeate and a sulphur spring.

BLUE SULPHUR SPRINGS,

CABELL COUNTY.

Post-office, Blue Sulphur Springs. Hotel. These springs are located thirteen miles from Huntington, on the Chesapeake and Ohio R. R. The elevation is about 500 feet above the sea-level, and the surrounding country is of a broken and hilly character, presenting a great diversity of scenery. Just back of the springs is the Mud River, a picturesque stream by no means deserving of its homely appellaton. This river is quite narrow, and the luxurious growth of trees on either side forms a natural arch over the stream, lending it an appearance of sylvan beauty seldom excelled. There are numerous lovely walks and rambles over the mountains nearby. The surface is covered with the original forest trees, among which the sweet-scented pine is profusely intermingled, giving the air a pleasing blend of fragrance and salubrity. The waters of the springs have been used for about forty-five years, but until recently few improvements were made. A comfortable hotel has been built, and the resort seems to be launched on a career of prosperity which the attractiveness of the spot warrants. No analysis has been made of the waters, but they appear to be decidedly sulphurous in character. The springs are two in number, but their outflow has never been calculated.

NOTE.—These springs should not be confounded with the Blue Sulphur Springs of Greenbrier County, which appear to have lapsed into disuse.

BORLAND MINERAL WELL,

PLEASANTS COUNTY.

The well from which the Borland Mineral water flows is situated on the bank of Blue Creek, six miles from Salama, on the Ohio River R. R., and thirty miles northeast of Parkersburg. At present there is no hotel in the vicinity, but nearby farm-houses accommodate a limited number of guests who wish to use the water from the well. The surrounding hills and valleys present some very pleasing landscapes. The water rises from a flowing well, being forced upward by the natural-gas pressure from a depth of three hundred feet. An analysis by Prof. T. G. Wormley, of Philadelphia, showed the following mineral ingredients :

BORLAND MINERAL WELL.

Alkaline. Muriated-saline. Sulphureted.

One U. S. gallon contains :

Solids.	Grains.
Sodium chloride	240.07
Sodium bicarbonate	112.16
Sodium sulphate	37.84
Magnesium bromide	0.28
Potassium sulphate	22.62
Magnesium iodide	0.02
Magnesium chloride	2.13
Calcium bicarbonate	12.59
Magnesium bicarbonate	3.12
Aluminium phosphate	0.23
Aluminium and iron carbonate	0.64
Manganese	Trace.
Silica	0.58
Organic matter	Trace.
Total	432.28

Sulphureted hydrogen, a perceptible quantity.

This water is a very efficient antacid laxative, with diuretic and diaphoretic properties. It also derives a certain tonic and restorative influence from the presence of iron, phosphorous, and manganese. It has not disappointed expectations in actual practice, and has become one of the well-known commercial waters of the country. In addition to its table value it has been found to possess excellent therapeutic properties in chronic affections of the stomach, bowels, liver, and kidneys. It acts with great efficacy in renal dropsy.

CAPON SPRINGS,

HAMPSHIRE COUNTY.

Post-office, Capon Springs. Hotels and cottages. Access *via* Baltimore and Ohio R. R. to Capon Springs Station, thence a drive of fifteen miles over mountain roads to springs.

This well-known resort is situated four miles from the base of the Great North Mountain, at an elevation of 1800 feet above tidewater. The scenery here is varied and pleasing, and the climatic conditions during the season from May 15th to about the end of October all that could be desired. The average summer temperature is about 65° F., the mercury seldom ranging above 75° F. The main hotel is a large building, five stories in height, and well supplied with modern appliances and accessories for the safety and comfort of the guests. There are two smaller hotels and a number of cottages. The main spring discharges about 12,000 gallons of water per hour, at a temperature of 66° F. An analysis by Prof. J. W. Mallet shows the following results:

CAPON SPRINGS.

Light Alkaline-calcic.

One U. S. gallon contains:[1]

Solids.	Grains.
Calcium carbonate	0.59
Magnesium carbonate	1.44
Iron carbonate	0.04
Manganese carbonate	Trace.
Calcium carbonate	8.32
Lithium carbonate	Trace.
Sodium chloride	0.06
Potassium sulphate	0.16
Calcium sulphate	0.59
Strontium sulphate	Trace.
Calcium phosphate	"
Calcium fluoride	"
Alumina	0.02
Silica	0.72
Nitrates	Trace.
Organic matter	0.20
Total	12.14
Gases.	**Cubic inches.**
Carbonic acid	8.56
Oxygen	1.76
Nitrogen	3.68
Total	14.00

A second spring, known as the Beauty Spring, has a similar composition.

The waters have been found of service in the treatment of gastric catarrh, the acid forms of dyspepsia, uric-acid gravel, and catarrh of the bladder. It is said that farmers have brought their horses for many years to drink the waters as a remedy for botts, large numbers of larvæ being thereby discharged dead. A large and tastefully arranged bathing establishment is maintained at the resort. A swimming pool 98x48 feet is supplied by the main spring. Plunge, shower, douche, and warm baths may be had at the option of the visitor. The water is used commercially, and has the indorsement of many well-known Philadelphia medical men.

COLUMBIA WHITE SULPHUR SPRINGS,

Greenbrier County.

Post-office, Columbia Sulphur Springs. Access *via* Chesapeake and Ohio R. R. to Greenbrier White Sulphur Springs; thence by stage twenty miles to Columbia Springs. A branch railroad, when completed, will pass within four miles of the springs.

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[1] Converted from grains per pint.

The location is in a beautiful valley at the foot of the Alleghany Mountains, and has an elevation of 2050 feet above the sea. The usual attractive features of scenery and climate prevalent in the Alleghanies will be found here. The springs are comparatively unimproved so far, but a hotel is under contemplation. There is but one spring, which yields about 60 gallons of water per hour. It is always cool, and is very palatable. No analysis has been made, but the sediment thrown down by the water shows it to be strongly sulphurous. It has a considerable local reputation in the treatment of stomach troubles and skin diseases.

GREENBRIER WHITE SULPHUR SPRINGS,

Greenbrier County.

Post-office, White Sulphur Springs. Hotel and cottages. Access *via* main line of the Chesapeake and Ohio R. R. direct to springs.

This celebrated summer watering-place is located on the western slope of the Appalachian Mountains, at an elevation above tide-water of more than 2000 feet. The situation is well within the famous spring region. Within a radius of thirty miles are the Rockbridge Alum, the Hot, the Warm, the Healing, the Sweet, and other well-known springs, while the Natural Bridge, Millboro, the Alleghany, and other resorts are nearby. For many years past the Greenbrier White Sulphur Springs have been regarded as the representative summer resort of the South, and it has lost none of its ancient and well-deserved prestige by the development of other springs. As in antebellum days, here will still be found the best elements of the social life of the South, with a generous intermingling of Northern beauty and gallantry drawn thither by the numerous attractions of the place. The surrounding scenery typifies the picturesque beauty and grandeur of the Alleghanies. Forest, vale, and mountain are here in rare and unique combination, presenting at every turn new views of the romantic, the beautiful, and the grand sufficient to gratify every taste. The visitor from the heated and dusty city is at once attracted by the vast lawn of green, velvety turf, shaded by noble forest oaks, luxuriant sugar maples, and venerable pines. Under these monarchs of the forest wild flowers are seen in profusion and in great variety, from the tiny violet to the modest laurel and the gaudy rhododendron. Next the eye wanders through the curving walks and drives, intermingling and leading in various directions, attracting alike the rambling pedestrian or the driver of thoroughbreds. Among the surrounding mountains are "Kate's" and "Greener," each a mile distant and reaching an altitude of 3500 feet, and the mountains known as "White Rock," three miles distant, the summits of which form a figure of gigantic size, known as the old "Titan," which, in solitary grandeur, keeps guard like a giant over the White Sulphur. What has been said regarding the climate of other Alleghany resorts applies in full measure to this. The mean annual temperature from April 15th to November 15th is about 63° F., or about the same as the mean annual temperature at Naples, Nice, and Madeira. The atmosphere is salubrious and invigorating, and at no time excessively warm. The Grand Hotel, with its one hundred cottages, gives accommodation to an immense number of visitors. The hotel buildings are in the old colonial style, and in their spacious halls or on their broad piazzas the visitor experiences all that has given Southern society its distinctive character. The parlor at the Grand is a magnificant room, half as large again as the east room in the President's mansion. The ball-room is of the same dimensions, while the dining-room is more than three hundred feet in length, and seats 1200 persons. There are two important springs here: (1) The famous old "White Sulphur;" (2) the "Chalybeate." The Sulphur Spring yields 1800 gallons of water per hour, which does not vary even during the longest spells of wet or dry weather. It has a uniform temperature at all times of 62° F. An analysis by Prof. A. A. Hayes, of Boston, shows the following mineral contents:

GREENBRIER WHITE SULPHUR SPRING.

Saline-calcic. Sulphureted.

One U. S. gallon contains: Solids.	Grains.
Calcium carbonate	7.07
Magnesium sulphate	35.42
Calcium sulphate	78.35
Silicates	3.46
Magnesium chloride	1.00
Organic matter	4.36
Total	129.66
Gases.	Cubic inches.
Carbonic acid	11.28
Sulphureted hydrogen	0.24
Oxygen	0.48
Nitrogen	4.64
Total	16.64

This analysis was made many years ago (1842), and a newer and further analysis is desirable. The water acts on the kidneys, bowels, liver, and skin. As a diuretic its effects are very soon apparent; but some days are usually required before it produces a decided action on the bowels. Its operation on the liver, too, may not be manifest for some time, and where there is much sluggishness of this organ some auxiliary medication is required. Its effect upon the skin is very apparent, though not immediate. The analysis does not fully explain another important action of the water, an effect which has been attested to by several generations of qualified medical men. This is its alterative power, or that peculiar influence by which it effects salutary changes or alteration in the blood, in the various secretions, and upon the numerous tissues of the body. No general directions can be given for the internal use of the water. The hours, the quantity, and the period for which the water should be drunk depend upon the individual requirements of the case, and should be ascertained by consulting a physician experienced in the use of such waters (*vide* Sulphur Waters). This water has been found by long experience to be beneficial in diseases due to abnormal conditions of the blood or to derangements of the stomach, liver, bowels, kidneys, skin, and nervous system. It is speedily curative in many cases of dyspepsia, chronic diarrhœa, costiveness, and hepatogenous jaundice. It is of great value in nervous affections, such as passive cerebral hyperæmia, neurasthenia, sciatica, and other forms of neuralgia. Combined with the influence of the favorable surroundings, the use of the water often proves curative in obstinate cases of chronic bronchitis, in hay-fever, bronchial asthma, and nasal catarrh. Conjoined with the use of the hot sulphur baths it is of decided value in rheumatism and gout, and is an efficacious adjuvant in the treatment of tertiary syphilis, chronic metallic poisoning, and dartrous skin diseases. According to Dr. Moorman, for many years the resident physician, the water is contraindicated in organic heart disease, carcinoma of the stomach, and phthisis pulmonalis. The water never proves beneficial when it persistently excites the frequency of the pulse.

The water used for bathing flows from the Sulphur Spring. The bathing establishment has recently been greatly enlarged and remodelled, and it is now believed that it will prove in all respects satisfactory to those wishing to avail themselves of its use.

The Chalybeate Spring. About forty rods from the White Sulphur Spring is a chalybeate spring in which iron exists in the form of carbonate. For the last twenty years this water has been considerably used by a number of visitors who require a ferruginous tonic, and its effects have realized the early hopes that its discovery created. It has not been fully analyzed.

IRONDALE SPRINGS,

PRESTON COUNTY.

Post-office, Independence. Access *via* Baltimore and Ohio R. R. to Hardman's Siding, one and one-half miles west of Independence; thence by the Iron Valley R. R. three and one-half miles to springs.

The Irondale Springs occupy a very attractive location about 1200 feet above the sea-level, but the place is not at present used as a resort. The water is bottled and used commercially, being recommended by physicians in many of the large Eastern cities. It has been analyzed by Prof. A. A. Breneman, formerly of Cornell University, with the following results :

IRONDALE SPRINGS.

Aluminous. Manganous. Calcic.

One U. S. gallon contains :

Solids.	Grains.
Calcium sulphate	60.42
Magnesium sulphate	4.34
Potassium sulphate	6.76
Aluminium sulphate	11.34
Manganese sulphate	2.86
Iron sulphate with cobalt and nitric acid	Trace.
Sodium chloride	1.36
Silica	1.44
Iodine with sodium	Trace.
Vegetable and volatile substances	8.24
Total	96.76

This water, as shown by the analysis, is exceptionally rich in manganese, besides containing a large amount of alum. The following facts relating to its therapeutic effects are gathered from an article contributed to the New York *Medical Times* by Dr. Samuel Swift : This water possesses undoubted tonic and diuretic properties. It also acts as a sedative to the gastric mucous membrane, and in virtue of this fact it is highly extolled in cases of gastric irritability. It acts well in the nausea and vomiting of pregnancy, and has been found useful in chronic diarrhœa. In Bright's disease and in anæmia and chlorosis it has seemed to possess decided remedial value. The water is not unpleasant to the taste, and has no disagreeable after-effects. The Irondale Spring salts, made by evaporating the water, are also on the market.

OLD SWEET SPRING,

MONROE COUNTY.

Post-office, Old Sweet Springs. Hotel. Access *via* Chesapeake and Ohio R. R. to Alleghany Station, where Concord coaches meet all passengers for springs.

The location of the Sweet Springs is more open than is generally the rule in mountain districts. They issue up in a valley of great loveliness, but are surrounded by mountain scenery of surpassing grandeur. The elevation is 2000 feet above the sea-level, and the climate during the summer months of the usual delightful character found in this region. The buildings at the springs are of brick, and of a very substantial character, and at the height of the season the place resembles a miniature city. Eight hundred guests are easily entertained at one time. The main building is about three hundred feet in length, and no expense has been spared to make it one of the best summer hotels in the country. The great dining-room, as well as the various parlors, ball-room, cottages, bath-house, and grounds, are brilliantly lighted by gas. The hotel property embraces a grass farm of 2000 acres, which guarantees an abundant supply of dairy products, while neighboring farms furnish the best of poultry, mutton, etc. The water of the Sweet Springs is not unpleasant to the taste, but its temperature, 79° F., renders it rather warm for general use in drinking. For bathing, however, it is very agreeable. Two pools have been provided, one for gentlemen, the other for ladies, each seventy-five feet long, twenty-five feet wide, and from three to five feet deep. The water is so clear that moss-covered stones on the bottom are distinctly visible. There are also warm and hot steam baths of both mineral and freestone water. The following analysis of the mineral water here was made by Prof. William B. Rogers:

OLD SWEET SPRINGS.

Alkaline-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Calcium sulphate	13.16
Magnesium sulphate	9.37
Sodium sulphate	6.32
Calcium carbonate	30.05
Magnesium carbonate	0.80
Calcium chloride	0.15
Sodium chloride	0.14
Magnesium chloride	0.31
Iron peroxide	0.15
Silica	0.17
Earthy phosphates	Trace.
Iodine	"
Total	60.62
Gases.	**Cubic inches.**
Carbonic acid	85.86
Nitrogen	4.31
Sulphureted hydrogen	Trace.
Oxygen	"

This is a very good alkaline-calcic water, possessing tonic, diuretic, alterative, and mild cathartic properties. It is valuable in functional disorders of the stomach, and is said to be employed with signal benefit in chronic diarrhœa and dysentery. It has also produced good results in rheumatism and in some forms of neuralgia, as well as in renal and urinary disorders.

RED SULPHUR SPRINGS,

MONROE COUNTY.

Post-office, Red Sulphur Springs. Hotel. Access *via* Chesapeake and Ohio R. R. to Alderson's; thence by stage to springs.

These springs are beautifully situated on Indian Creek, and are surrounded by pine-clad mountains. They are two in number, and flow 210 gallons per hour. The water has a temperature of 51° F. It was analyzed by Prof. A. A. Hayes in 1842, with the following results:

RED SULPHUR SPRINGS.

Light-saline-sulphureted.

One U. S. gallon contains:

Solids.	Grains.
Sodium carbonate	5.25
Calcium carbonate	4.81
Sodium sulphate	4.14
Calcium sulphate	0.55
Earthy phosphates	0.82
Organic matter with sulphur	8.39
Total	23.96
Gases.	**Cubic inches.**
Carbonic acid	8.00
Sulphureted hydrogen	1.04

A new analysis of this water is very much to be desired. Its virtues are presumed to rest to a great extent upon the enigmatical "organic matter with sulphur." Aside from this substance it is a very good light saline-calcic water, possessing some useful properties. It contains considerably more sulphureted hydrogen than is shown in the above table, the analysis having been made at Roxbury, Mass., far from the source of the spring. To the peculiar sulphurous organic substance, however, is attributed the well-attested influence of the water as an arterial sedative when taken internally. From abundant corroborative medical testimony there seems to be no doubt that the water causes a decided slowing of the heart's action in an excited state of the circulation. The water further seems to possess a peculiar tendency toward the mucous membrane of the lungs, allaying irritation and diminishing expectoration. In virtue of these properties it has often proved decidedly beneficial in hæmoptysis, early phthisis, chronic bronchitis, chronic pharyngitis, and chronic laryngitis. In small quantities the water is said to be cathartic, while in larger doses it is diuretic.

ROSE HILL (HART WELL),

PLEASANTS COUNTY.

Post-office, Willow Island. Hotel and cottages. Access *via* Ohio River R. R., or *via* steamboats to Willow Island, and thence one mile by hack to Rose Hill.

Rose Hill is the location of the well-known Hart Well. The resort is located in the oil region of West Virginia, ten miles above Marietta, Ohio, and twenty-two miles above Parkersburg, West Virginia. The location of the hotel is 300 feet above the Ohio River, of which it affords a fine view. The hotel is a substantial, well-ventilated building, and the landscapes visible in all directions from its double verandas are very pleasing. The well was discovered by prospectors while boring for oil. An analysis of the water by Prof. S. C. Wells, of Roanoke College, resulted as follows :

HART WELL.

Alkaline-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	30.44
Sodium bicarbonate	14.22
Sodium sulphate	4.75
Potassium sulphate	2.87
Magnesium bromide	0.04
Magnesium iodide	Trace.
Magnesium chloride	0.27
Calcium bicarbonate	1.59
Magnesium bicarbonate	0.40
Aluminium phosphate	0.03
Aluminium and iron carbonates	0.09
Manganesium	Trace.
Silica	0.07
Organic matter	Trace.
Total	54.77

This water is a very fair example of the alkaline-saline group, and will be found useful in the disorders to which such waters are applicable. Ample bathing facilities are provided. The place is evidently a very attractive one to those seeking a quiet retreat amid serene and peaceful hills and valleys surrounded by a salubrious and invigorating atmosphere.

SALT SULPHUR SPRINGS,

MONROE COUNTY.

Post-office, Salt Sulphur Springs. Hotels. Access *via* Chesapeake and Ohio R. R. to Fort Spring, where carriages meet visitors for springs.

These well-known springs have been under the present management for many years, and have become justly esteemed as one of the most charming and home-like of the Virginia Mountain resorts. The location is 2000 feet above the sea-level, and is surrounded by the usual beautiful scenery and wholesome climate of the Alleghanies. Five minutes' walk from the hotel lawn in any direction reveals to the eye a panorama of unexcelled loveliness. For twenty-five miles on every side the majestic mountains stretch their wooded lengths before the enraptured gaze, presenting a scene of impressive grandeur not soon to be forgotten. The hotel buildings are chiefly of brick and limestone. The largest, built of stone, contains seventy-two pleasant rooms, and has wide piazzas, two hundred feet long, overlooking the lawn. The parlor and great ball-room are also in this building. There are accommodations for three hundred guests. The springs are three in number, known as the "Old" or "Sweet" Spring, discovered in 1802; the "Salt Sulphur," in 1805, and the "Iodine" Spring, known since 1821. We present analyses of the Old Spring and the Iodine Spring, the former by W. B. Rogers, the latter by D. Stewart:

SALT SULPHUR SPRINGS.

Saline-sulphureted. Calcic.

One U. S. gallon contains: Solids.	Old Spring. Grains.	Iodine Spring. Grains.
Sodium carbonate	...	10.80
Calcium carbonate	10.26	33.00
Magnesium carbonate	3.31	7.00
Potassium carbonate	...	2.33
Sodium sulphate	22.36	24.00
Calcium sulphate	84.90	68.00
Magnesium sulphate	18.21	20.00
Earthy phosphates	Trace.	0.73
Sodium chloride	1.58	1.50
Calcium chloride	0.06	0.56
Magnesium chloride	0.26	0.28
Iron peroxide	0.10	1.06
Alumina	...	0.18
Silica	...	1.76
Iodine	Trace.	0.63
Bromine	...	0.65
Organic matter	9.24	...
Total	150.28	172.48
Gases.	Cubic inches.	Cubic inches.
Carbonic acid	13.28	34.56
Sulphureted hydrogen	3.44	19.12

These are valuable waters, containing as they do a large proportion of active mineral ingredients. Both contain a sufficient quantity of the purging sulphates to render them cathartic in their effects. The iodine spring contains a fair proportion of iron and appreciable quantities of iodine and bromine, rare ingredients of sulphur waters. This water resembles those of Challes, in Savoy, and possesses alterative properties. It proves especially beneficial in scrofulous and syphilitic diseases. The waters of both of these springs are useful in abdominal engorgement, chronic constipation, chronic metallic poisoning, functional hepatic disorders, rheumatism, gout, and scaly skin diseases. Cases of bronchial trouble and early phthisis also do well at this resort.

SHANNONDALE SPRINGS,

JEFFERSON COUNTY.

Post-office, Charlestown. Hotel. Access *via* Baltimore and Ohio or Norfolk and Western R. R. to Charlestown; thence five miles by carriage to springs.

This delightful old summer resort is situated in the bend of the Shenandoah River, at the foot of the Blue Ridge Mountains. Shannondale was formerly one of the most noted of the Virginia watering-places. The large hotel was burned during the war, and no other was built for a number of years. The present hotel has accommodations for upward of one hundred guests. It is pleasantly located and overlooks the Shenandoah River, where excellent boating and fishing may be had. The place is much frequented during the summer by visitors from Washington, Baltimore, Philadelphia, and other localities. It is highly esteemed for its fine scenery and for the beneficial character of the mineral waters. The springs are three in number. An analysis by Dr. Stewart showed the presence of 240 grains of solid ingredients to the United States gallon, consisting chiefly of the sulphate and carbonate of calcium and the sulphate of magnesium. There is also a small proportion of the sulphate and the carbonate of iron and an undetermined quantity of carbonic acid and sulphureted hydrogen gas. The water has laxative, diuretic, and tonic effects. It may be classed as a saline-calcic-chalybeate. There are several bath-houses at the resort.

The following springs in West Virginia are also used to some extent:

Aurora Highlands Spring, Aurora, Preston County.

Webster Salt Sulphur Springs, Webster County.

The Triplet Well, Calf Creek, Grant District, Pleasants County, is used commercially.

WISCONSIN.

The State of Wisconsin extends from 42° 31′ to 46° 58′ north latitude, and from 87° to 92° 53′ west longitude. The surface of the State, for the most part, is a great plain, varied only by cliffs bordering the rivers and lakes and elevated from 600 to 1800 feet above the ocean level. The State has a coast-line on Lake Michigan of two hundred miles, and on Lake Superior of one hundred and twenty miles. The Mississippi River forms a large part of its western boundary. Numerous small rivers drain the State, the largest of these being the Wisconsin. The surface is studded with an immense number of small lakes, some of which are of great beauty. Lake Winnebago is the largest of these, being thirty miles long and eleven miles wide at its greatest diameter. The State is noted for the great beauty of its gently rolling prairies and for its numerous picturesque waterfalls. The most noted rapids are found on the upper Wisconsin, the Bad, the Montreal, the St. Louis, and the Menominee Rivers. The central and southern portions of the State are almost wholly covered by immense forests. Many curious mounds and earthworks, vestiges of a pre-historic race, crown the hill-tops and dot the lake shores and river banks within the borders of the State. Occupying the latitude it does, and lying near the centre of North America, Wisconsin has a typical temperate continental climate. Its summers are warm, and diversified by short rains and clear skies; its winters are somewhat severe, but relatively dry and stimulating, and are less chilly than more humid atmospheres at similar or even higher temperatures. The average rainfall is about 30 inches. The mean summer temperature varies from about 70° F. in the south to about 60° F. in the north; the mean winter temperature from about 25° F. in the south to about 15° in the extreme north. The great lakes produce a marked effect on the seasonal temperature of the State, elevating it in winter and depressing it in summer, so that the summer isotherms run from the northwest to southeast, driven south by the cooling influence of the lakes; while those of the winter run from southeast to northwest, forced north by their warming influence.

The mortality-rate for Wisconsin, according to the National Census returns of 1890, was 11.06 per 1000 of population. The phthisical mortality-rate was 1.19 per 1000 of inhabitants.

The mineral springs of Wisconsin are of great value and importance. The production of mineral water for commercial use exceeded 3,000,000 gallons in 1895, or more than that of any other State. The springs are largely of the alkaline-saline-calcic varieties, a few being sulphureted. The following account, with the exception of the Sparta Spring, is derived entirely from a recent personal investigation in the State. The older works contain scarcely any reference to the Wisconsin springs.

ALLOUEZ MINERAL SPRINGS,

Brown County.

Post-office, Green Bay. Hotels in Green Bay. The Allouez Springs are beautifully located near the base of an elevation (Astor Heights) in the southern part of the city of Green Bay. The water bubbles out from the hillside at a uniform rate all the year. It has a temperaure of 46° F. A pretty park surrounds and an ornamental pavilion covers the spring, which gushes up through an octagonal marble basin. An attendant in charge supplies water to the visitors. It is believed that the Menominee Indians made use of the spring. The water was analyzed in 1888 by Prof. W. W. Daniels, of the Wisconsin State University:

ALLOUEZ MINERAL WATER.

Alkaline-saline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	4.26
Potassium sulphate	0.12
Sodium sulphate	3.46
Calcium sulphate	0.11
Sodium phosphate	Trace.
Iron bicarbonate	0.06
Calcium bicarbonate	24.69
Magnesium bicarbonate	27.53
Alumina	0.17
Silica and insoluble residue	1.97
Total	62.37

There is a very fortunate combination of mineral ingredients in this water. The principal ingredient, the bicarbonate of magnesia, gives it valuable antacid and laxative effects. The latter action is aided somewhat by the sulphate of sodium. Authorities are agreed that the carbonate of magnesia is an excellent antilithic in those cases in which uric acid is too abundant. The small proportion of bicarbonate of iron which we find is sufficient to impart tonic effects to the water. The chloride of sodium, sulphate of sodium, and bicarbonate of magnesium all contribute to render the water diuretic. The water is soft and sparkling, and as it contains no trace of organic or vegetable matter, is well adapted for general table use. In diseased states the best effects of the water have been observed in diabetes, Bright's disease, disorders of the stomach and liver, and in gout, rheumatism, and vesical calculi.

The charming city of Green Bay lies at the head of the bay of the same name, and is one of the oldest settlements of the Northwest. In the year 1668 Father Allouez established a missionary station here, and from that period dates the first settlement of the city. The springs are located but a short distance from the site of the old mission, and are named in honor of its intrepid and worthy founder. Green Bay offers excellent advantages as a health resort. Its elevated location renders the air cool and refreshing during the summer months, and malaria is unknown. The magnificent Fox River, which flows into the bay at this point, is spanned by five bridges. The streets are embowered with avenues of grand old trees, and there are excellent drives in every direction for miles around. Small steam and sailing yachts, with their burdens of pleasure-seekers, ply the placid waters of the bay, forming a picture of serene and restful beauty during the spring and summer months.

ARCTIC SPRINGS,

TREMPELEAU COUNTY.

Post-office, Galesville. Hotels. These springs are situated near the village of Galesville, at the terminus of a branch of the Chicago and Northwestern R. R. The springs are at the head of a small lake called "Marinuka," while the village is at the foot, about a mile away. During the summer a small steamer, carrying fifty passengers, plies between the two points. The location is 750 feet above the sea-level. The surrounding country is broken by ranges of elevations known as "bluffs," between which are beautiful and productive valleys from one to three miles wide. Smaller depressions intersect the main valleys at intervals of about a mile. All of these valleys contain clear trout streams coursing down their centres. This peculiar conformation of the surface gives the country an aspect of picturesque beauty not soon to be forgotten. The fine scenery and salubrious climate are beginning to attract visitors to this region in rapidly increasing numbers. A large hotel is badly needed. The springs flow from beneath a precipitous bluff out of the rocks, filling a pipe six inches in diameter. The water as it flows has a temperature of 48° F. It never becomes putrid even after months of standing. The following analysis was made by Prof. W. W. Daniels, of the State University:

ARCTIC MINERAL SPRINGS.

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Potassium sulphate	0.19
Sodium sulphate	0.07
Sodium chloride	0.76
Calcium chloride	0.05
Calcium bicarbonate	13.65
Magnesium bicarbonate	9.84
Iron bicarbonate	0.26
Alumina	0.15
Silica	0.06
Total	25.03

The water is a fairly potent alkaline-calcic, with light chalybeate properties. It is useful in acid dyspepsia, chronic constipation, renal congestion, the early stages of Bright's disease, and in general debility. The water is now on the market. Galesville is a thrifty, bustling village of rather more than 1000 inhabitants, and numbers among its attractions telegraph and telephone facilities, electric lights, water-works, a magnificant water-power, etc.

FORT CRAWFORD MINERAL WELL,

Crawford County.

Post-office, Prairie Du Chien. Hotels. Access *via* Chicago, Burlington and Quincy, and Chicago, Milwaukee and St. Paul Railroads.

Prairie Du Chein contains about 4000 inhabitants, and is one of the oldest towns in the State. The well from which the mineral water is obtained was bored in 1876. At a depth of nine hundred and sixty feet a strong flow of water was encountered, and ever since there has been a continuous stream, six inches in diameter and having a pressure of twenty pounds to the square inch. The well yields about 40,000 gallons per hour. By means of mains and hydrants it furnishes the city fire department, and affords an abundance of water for domestic purposes. It was soon learned that the water possessed medicinal effects. An analysis by Prof. Bode, of Milwaukee, showed the following results :

FORT CRAWFORD MINERAL WATER.

Alkaline. Muriated and Sulphated Saline.

One U. S. gallon contains :

Solids.	Grains.
Calcium bicarbonate	0.62
Magnesium bicarbonate	10.97
Sodium chloride	90.20
Potassium chloride	3.80
Sodium bromide	0.13
Sodium sulphate	12.80
Calcium sulphate	15.38
Iron bicarbonate	0.23
Sodium phosphate	Trace.
Sodium bicarbonate	"
Alumina	0.66
Silica	3 84
Organic matter	None.
Total	138.63

This is a valuable member of the widely useful alkaline-saline class of waters. It closely resembles some of the Saratoga waters in its mineral constituents, being, however, somewhat milder than those waters. Its chief effects are antacid, laxative, diuretic, and tonic. It is well adapted for the class of diseases to which such waters are applicable. It is also an excellent table water. A well equipped sanitarium, with ample bathing facilities, is conducted in connection with the well. The water is used commercially.

HACKETT SPRINGS,

MILWAUKEE COUNTY.

Post-office, Hale's Corners. Hotels. The information we have been able to secure concerning these springs is quite meagre. They are located in a rolling country, about 800 feet above the sea-level.

The summer weather is stated to be very variable, while the autumns are fine and clear. The temperature in summer ranges from 60° to 98° F.; in winter from 60° above to 20° below. There are four large springs and numerous small ones. The combined currents form a small river. Drs. Sayle and McShayne, of Hale's Corners, have furnished us with the following analysis, made by Prof. Gustavus Bode, of Milwaukee:

HACKETT SPRINGS.

Light Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.24
Sodium sulphate	1.03
Sodium bicarbonate	0.46
Calcium bicarbonate	8.40
Magnesium bicarbonate	6.23
Iron bicarbonate	0.36
Alumina	0.11
Silica	0.87
Total	17.70

This water possesses the properties of a mild alkaline diuretic, and antacid.

PALMYRA MINERAL SPRINGS,

JEFFERSON COUNTY.

Post-office, Palmyra Springs. Hotels and sanitarium. Access *via* Chicago, Milwaukee and St. Paul R. R. to Palmyra, one hundred and eighteen miles north of Chicago and twenty miles west of Waukesha. The sanitarium stage meets trains.

Palmyra is a pretty little town of 1000 inhabitants, nestling in the foothills of the famous Kettle Range of Wisconsin. The location is 850 feet above tide-water, and it combines many of the features sought after by the summer seeker for health or recreation. This entire section is favored with a salubrious climate, and is entirely free from malaria. The soil is dry, sandy, and porous, overlying glacial deposits of gravel, which afford the best natural facilities for thorough drainage. The scenery here is noted for its tranquil beauty and loveliness. In his attractive brochure on "Summer in the Northwest" Mr. W. J. Anderson informs us that the beautiful little Spring Lake, or Palmyra Lake, as it is generally called, "may be classed as one of the gems of Wisconsin. Its bottom is covered with mosses, ferns, and other aquatic plants, which in midsummer bloom and blossom as a garden. It is fed by numerous mineral springs in the vicinity, and affords an enticing prospect for the angler or the lover of boating." Seven miles distant is the Scuppernong trout pond, which is said to contain millions of trout of all varieties and sizes. Many other beautiful lakes are within easy driving distance, over excellent roads. The Palmyra Springs Sanitarium is delightfully situated on the margin of Palmyra Lake, of which it commands a charming view. This is a substantially built brick structure, four stories in height, containing spacious halls, wide verandas, and all the modern accessories for the health and comfort of its occupants. There are facilities for the administration of electricity in its various forms, massage, etc. The baths embrace salt, shower, shampoo, Turkish, Russian, and natural mineral water baths, the rooms being spacious and luxuriously furnished. All kinds of facilities for indoor and outdoor diversions are at the option of the guests. These include a large gymnasium, a theatre, or music hall, for ladies and gentlemen billiard parlors, bowling alleys, archery and tennis courts, etc. Directly opposite the sanitarium is a forty-acre forest of native oaks —the "Sanitarium Grove." Its winding walks and shaded nooks add no little to the attractiveness of the place. At a distance of one and a half miles from the sanitarium is the great Geyser Spring. It is thirty-eight feet in depth and fifty feet across the surface, and supplies 10,000,000 gallons of water per day. The water is soft, pure, and palatable, and is believed to possess remedial value. The mineral springs at Palmyra are very numerous. A cluster of half a dozen in the springs park, which could all be covered by a canvas forty feet square, are quite dissimilar in taste, of varying temperature, and of different analysis. One spring is slightly thermal, having a temperature of 72° F.; another, ten feet distant, is 62½° F.; two others of 52° temperature, while others are as low as 50° F. Back of the sanitarium, and four hundred feet from it, is another group, known as Magnesian Springs. They are remarkably pure and free from organic matter. Following are analyses of three of the springs, No. 1 being by Prof. W. S. Haines, of the Rush Medical College, Chicago, and Nos. 2 and 3 by Prof. Bode, of Milwaukee:

SPRING NO. 1 (PALMYRA SPRINGS).

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium sulphate	0.94
Potassium sulphate	0.23
Calcium bicarbonate	15.70
Magnesium bicarbonate	10.94
Magnesium chloride	0.18

One U. S. gallon contains:

Solids.	Grains.
Iron bicarbonate	0.05
Calcium phosphate	Trace.
Alumina	"
Silica	0.70
Organic matter	Trace.
Total	28.74

SPRING NO. 2 (PALMYRA SPRINGS).

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.21
Sodium sulphate	0.64
Sodium bicarbonate	0.16
Calcium sulphate	0.30
Calcium bicarbonate	9.86
Magnesium bicarbonate	7.91
Iron bicarbonate	0.06
Alumina	0.19
Silica	0.61
Organic matter	0.35
Total	20.29

SPRING NO. 3 (PALMYRA SPRINGS).

Alkaline-calcic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	0.43
Sodium sulphate	0.40
Sodium bicarbonate	0.18
Calcium sulphate	0.80
Calcium bicarbonate	12.84
Magnesium bicarbonate	10.14
Alumina	0.22
Silica	0.90
Total	25.91

These waters all possess mild diuretic and antacid properties. The water of Spring No. 3, being entirely free from organic matter, is well adapted for carbonating and bottling. The numerous topographical, climatic, and other advantages of Palmyra render it a suitable resort for a large variety of ills and ailments. The spring waters exert a beneficial influence, especially in rheumatism and dyspepsia, although their use is also extended to functional hepatic disorders, the early stages of Bright's disease, and to eczema, pityriasis, and other skin troubles.

SALVATOR MINERAL SPRINGS,

BROWN COUNTY.

Post-office, Green Bay. This spring is the source of the Salvator Mineral Water. It does not appear to be used as a resort. An analysis by Prof. Delafontaine, of Chicago, shows the following mineral ingredients :

SALVATOR MINERAL SPRINGS.

Alkaline-calcic. Chalybeate.

One U. S. gallon contains :

Solids.	Grains.
Sodium chloride	1.60
Sodium bicarbonate	1.30
Calcium bicarbonate	20.00
Magnesium bicarbonate	17.60
Iron bicarbonate	1.30
Total	41.80

This analysis shows an excellent alkaline, diuretic, and mild laxative water, with ferruginous properties. It is valuable in the treatment of acid dyspepsia, sluggishness of the portal circulation, Bright's disease, diabetes, and irritable states of the bladder and urinary passages. The water is entirely free from organic impurities, and is well adapted for table and club purposes. It has a large sale in different sections of the country.

SHEBOYGAN MINERAL WELL,

SHEBOYGAN COUNTY.

Post-office, Sheboygan. Hotels. Access *via* the Ashland division and also the Fond du Lac division of the Chicago and Northwestern R. R.; also *via* steamers on Lake Michigan.

The city of Sheboygan is beautifully located at the entrance of the Sheboygan River into Lake Michigan, at an elevation of about 650 feet above the level of the Atlantic Ocean. The mineral well is located in Fountain Park, and is 1475 feet in depth. It was bored in 1875, and extends down to the granite bedrock. Abundant water was discovered, the pressure, as indicated by the gauge, being fifty-two and one half pounds to the square inch, or sufficient to raise a column of water to the height of one hundred and fifteen feet. The well was carefully tubed, and the water is pure, bright, and sparkling, and entirely free from all surface contamination. The following analysis was made by Prof. Charles F. Chandler, of New York, in 1876 :

SHEBOYGAN MINERAL WELL.

Muriated-saline. Sodic and Magnesic.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	306.94
Potassium chloride	14.48
Lithium chloride	0.11
Magnesium chloride	54.91
Calcium chloride	27.82
Sodium bromide	0.19
Sodium iodide	Trace.
Calcium sulphate	16.98
Baryta sulphate	Trace.
Calcium bicarbonate	13.66
Iron bicarbonate	0.59
Manganese bicarbonate	0.17
Calcium phosphate	0.04
Sodium biborate	Trace.
Alumina	0.13
Silica	0.47
Organic matter	Trace.
Total	436.49

This water is seen to be very highly mineralized, and is closely allied to those of Kissingen and Kreutznack, in Germany. It contains, however, in addition to all the mineral constituents of those waters (except the nitrate of soda in Kissingen), traces of sulphate of baryta and biborate of soda, and a small quantity of bicarbonate of manganese. It has practically the same therapeutic properties as those waters, and is applicable to the same conditions. The most pronounced effects are laxative, diuretic, and tonic. It seems to act as a stimulant to the mucous membrane generally, and promotes the secretions. It is highly recommended as a remedy in chronic constipation. It is further applicable to a large class of morbid conditions depending upon a deranged circulation and defective secretion, such as dyspepsia, functional disturbances of the liver, hemorrhoids, anæmia and chlorosis, rheumatism, etc. The water is bottled and sold all over the country.

SPARTA MINERAL WELLS,

MONROE COUNTY.

Post-office, Sparta. Hotel. Access: Sparta is a station on the Chicago, Milwaukee, and St. Paul R. R., two hundred and fifty-five miles from Chicago.

Bulletin 32 of the United States Geological Survey reports twelve mineral wells in Sparta, only two of which appear to have been analyzed. We present the following analysis of the Magnetic Well, made by J. M. Hirsh in 1876:

MAGNETIC MINERAL WELL (SPARTA).

Chalybeate.

One U. S. gallon contains: Solids.	Grains.
Sodium carbonate	0.17
Magnesium carbonate	3.35
Iron carbonate	11.94
Manganese carbonate	Trace.
Calcium carbonate	0.33
Ammonium carbonate	Trace.
Lithium carbonate	"
Strontium carbonate	"
Barium carbonate	"
Potassium sulphate	0.53
Sodium sulphate	1.84
Calcium sulphate	0.14
Sodium chloride	0.12
Calcium chloride	0.50
Sodium phosphate	0.05
Aluminium phosphate	0.05
Sodium iodide	Trace.
Silica	0.23
Total	19.25

This analysis shows an almost pure chalybeate, the remaining ingredients being all of a secondary character. The water possesses the properties of a good ferruginous tonic.

WAUKESHA MINERAL SPRINGS,

Waukesha County.

Post-office, Waukesha. Hotels and boarding-houses. Access *via* Chicago and Northwestern, Chicago, Milwaukee and St. Paul, and Wisconsin Central Railroads. An electric line is also being built from Milwaukee.

Waukesha, the county-seat of Waukesha County, is located sixteen miles west of Milwaukee and ninety-eight miles northwest of Chicago. The elevation here is about 800 feet above tide-water. The surrounding country is of a rolling character, well wooded, and has a sandy, gravelly soil. The natural advantages of the place have made it a general society centre of the Northwest during the summer season. The usual population of about 6400 is increased during the hot months to more than 10,000. In the year 1895 there were 143 clear days, 130 partially cloudy, and 92 cloudy days. The summer weather is usually of a delightful character, and quite free from days of oppressive heat. The average rainfall from 1892 to 1895, inclusive, was 28.02 inches. The village contains eleven hotels and more than forty boarding-houses. In addition the houses of private citizens are often thrown open to visitors. Among the best known hotels are the Fountain Spring House, with accommodations for 8[illegible] guests; the Park, 300; the Spring City, 250; National, 150; Terrace, 100; Coleman, 100. Most of the hotels maintain bands during the season. Open-air public concerts are also given morning and evening. There is one theatre in the place, besides two public halls. The Fox River runs through Waukesha, and is large enough for row-boats. This is a region of lakes, there being no less than thirty-six in Waukesha County, the most remote being only eighteen miles distant. The lakes are surrounded by hotels and cottages, and during the summer they constitute a vast picnic-grounds. The prime attraction of Waukesha, however, is found in the great group of mineral springs located here. The waters of these springs are chiefly alkaline, chalybeate, and calcic. They have become known throughout the United States. Following are analyses of some of the most important:

WAUKESHA MINERAL SPRINGS.

Alkaline-saline. Calcic.

One U. S. gallon contains solids.	Bethesda.	Clysmic.			Fountain.	Hygeia	Silurian.	Vesta.
		1	2	3				
	C. F. Chandler.	Rathbone.	R. O. Doremus.	R. O. Doremus.	Blaney.	A. Thiel.	W. S. Haines.	G. Bode.
	Grs.	Grs.	Grs.	Grs	Grs.	Grs.	Grs.	Grs.
Sodium bicarbonate	1.26	1.26	4.31	0.80	1.02	2.26	0.03	0.41
Calcium carbonate	......	......	......	......	......	......	9.93	
Calcium bicarbonate	17.02	16.04	16.15	15.90	13.78	16.73	......	13.43
Magnes. carbonate	......	......	......	......	......	......	6.83	
Magnes. bicarbonate	12.39	13.56	9.22	8.54	9.20	13.14	......	10.74
Iron carbonate	......	......	......	......	......	......	0.13	
Iron bicarbonate	0.04	0.04	0.57	0.69	0.05	0.58	......	0.05
Iron phosphate	......	......	......	......	......	......	trace	
Sodium sulphate	0.54	0.56	0.69	1.08	0.36	0.52	0.29	0.55
Manganese phosphate	......	......	......	......	......	......	trace	
Potassium sulphate	0.46	0.46	0.50	0.20	......	0.82	......	
Sodium phosphate	......	0.03	0.43	0.45	......	0.04	......	
Sodium chloride	1.16	1.17	0.35	0.55	trace	1.25	0.19	0.30
Aluminium oxide	0.12	trace	......	......	0.09	0.72	0.59	0.13
Alumina	......	......	trace	trace	......	......	......	
Silica	0.74	0.72	0.80	0.81	0.85	0.15	0.70	0.85
Organic matter	1.98	1.62	trace	trace	0.31	trace	trace	
Total	35.71	35.46	33.02	29.02	25.36	36.21	18.69	26.46

Other well-known springs at Waukesha are the "White Rock," "Glenn," "Horeb," "Gibson," "Siloam," "Mineral Rock," and "Vitaqua."

It will be observed that the principal ingredient of all these waters is the bicarbonate of magnesium. Their action in the system is antacid, mildly laxative after continuous use, and diuretic. They have a useful application in dyspepsia, abdominal engorgement, Bright's disease, diabetes, and bladder troubles. Some of them are excellently adapted for the table. The waters of a num-

The following Wisconsin springs are also used more or less as resorts We have been unable to obtain recent reports from them : ber of these springs are carbonated or otherwise treated and sold in all parts of the United States.

Gihon Springs, Delavan, Walworth County.
Iodo-Magnesian Springs, Beloit, Rock County.
New Saratoga Springs, Star Prairie, St. Croix County.
Richmond Spring, Whitewater, Walworth County.
St. Croix Mineral Spring, near East Farmington, Polk County.
Shealtiel Mineral Springs, near Waupaca, Waupaca County.
Sheridan Springs, Lake Geneva, Walworth County.
Tellula Mineral Spring, Appleton, Outagamie County.

The following springs are used commercially:

Bay City Springs, Ashland, Ashland County.
Bethania Springs, Osceola, Polk County.
Castalia Springs, Wauwatosa, Milwaukee County.
Darlington Mineral Springs, Darlington, Lafayette County.
Lebens Wasser, Green Bay, Brown County.
Nee-Ska-Ra Mineral Spring, Wauwatosa, Milwaukee County.
Sparkling Spring, Milwaukee, Milwaukee County.
St. John Mineral Spring, Green Bay, Brown County.
Wautoma Mineral Spring, Waushara County.

The following additional springs at Waukesha are also used commercially:

Almanaris Springs.
Arcadian Spring.
Elein Spring.

WYOMING.

Wyoming is situated between the parallels of 41° and 45° north latitude, and 104° and 111° west longitude. The surface forms an extensive plateau and mountain region, having an average elevation of 6400 feet above tide-water. The main chain of the Rocky Mountains extends across the State from northwest to southeast, forming the Continental Divide. The principal ranges of the Rockies in Wyoming are the Wind River, in the northwest; Big Horn, north of the centre; Laramie, in the east; Bishop, west of the main chain; and the Rattlesnake Hills and Sweet-water Mountains, in the central portion, on the Sweet-water River. The Black Hills lie partly in this State and partly in South Dakota, while the Yellowstone National Park is formed from its northwestern corner. The highest elevation in the State is Fremont's Peak, of the Wind River Range, which reaches an altitude of 13,790 feet. The lowest portions are along the northern and eastern borders, where in several places the surface is less than 5000 feet above the sea-level. The mountain region of the State presents some of the most magnificent scenery in the world. The Union Pacific R. R., which traverses the State, follows the plateau which forms the part lying between the Missouri and the Colorado Rivers. The traveller by this road, therefore, sees but little of the mountains except at a distance. The mountains are covered with a thick growth of pine, spruce, and hemlock trees of large size; the foothills have pine, spruce, aspen, walnut, elm, ash, box-elder, and red cedar, while the river bottoms are abundantly supplied with two species of cottonwood and thickets of willow. The mountain regions of Wyoming are well watered by numerous streams, but the broad valleys and the plains are poorly supplied. Many of the streams which flow full in the mountains the entire year run dry in the summer upon the plains. None of the rivers is navigable. Upon the mountains the rainfall probably reaches, if it does not exceed, 30 inches annually. In the lower and more level sections it is from 8 to 15 inches, being greater in the eastern part and diminishing toward the west. The temperature varies with the elevation. In the valleys and on the plateaus and plains the annual temperature is between 40° and 50° F. Upon the mountains it progressively diminishes until, at an elevation of 10,000 feet, it reaches approximately 30° to 34° F. According to the United States Census of 1890, the death-rate for Wyoming was 6.82 per 1000 of population. The mortality from consumption was at the rate of 0.30 per 1000 of population.

Exclusive of the Yellowstone National Park, the list of the United States Geological Survey credits the State of Wyoming with twenty-eight mineral spring localities. This list is doubtless far from complete, as many parts of the State are still in a comparatively primitive condition. As far as known, the waters are chiefly of the silicious, calcic, and sulphureted classes. There are also a few salines and chalybeates. No spring localities in Wyoming are mentioned by Moorman, Walton, or Bell. We have addressed letters to all the localities mentioned in the Geological Reports, as well as to a number of postmasters, physicians, and others living in the State. As a result we have obtained an account of one locality now in use as a resort.

RAWLINS' SULPHUR SPRINGS,

CARBON COUNTY.

Post-office, Rawlins. Hotels. These springs are pleasantly located about two miles from the enterprising town of Rawlins. The situation is on an elevated plateau, at an altitude of 6400 feet above the sea-level. The surrounding country is rugged and mountainous. The following analysis was made in 1894 by E. E. Slosson, of the School of Mines of the University of Wyoming, at Laramie:

RAWLINS' SPRINGS.

Saline-calcic. Sulpho-carbonated.

One U. S. gallon contains:

Solids.	Grains.
Potassium chloride	1.40
Sodium chloride	12.18
Sodium sulphate	8.54
Magnesium sulphate	18.23
Calcium sulphate	19.28
Calcium carbonate	7.41
Silica	8.23
Carbonic acid	0.82
Total	76.09

Temperature of water at spring, 48° F.

The water is said to be highly sulphureted as it flows. The above analysis having been made at a distance from the springs, this gas was lost by volatilization. Therapeutically, the water has been fully tested in only one disease, viz., rheumatism. In this affection it is stated to be very efficacious, both internally and in the form of hot baths. The water, as shown by the analysis, should possess very good diuretic and laxative properties. A first-class hotel and bath-house are much needed to put the resort on a good footing. The natural advantages of the place appear to offer excellent inducements for the establishment of a sanitarium.

The following springs are also used to some extent:

Leroy Springs, near Leroy Station, Uinta County.

Saratoga Springs, Saratoga, Carbon County.

YELLOWSTONE NATIONAL PARK.

Access *via* the Northern Pacific R. R. to Livingston, Montana; thence by a branch line of the Northern Pacific to Cinnabar, a point on the northern border of the Park, fifty-one miles from Livingston. From Cinnabar the trip is continued by a daily stage line to the Mammoth Hot Springs, seven miles distant, from whence the tour of the Park proper is made in the stage coaches of the Yellowstone National Park Transportation Company. The tourist-season extends from June 1st to October 1st.

In 1872 an Act of Congress was passed setting aside forever as a public park a section of country in the Rocky Mountain chain in the northwestern corner of Wyoming, which at once became known as the Yellowstone National Park. This tract is about fifty-four miles in width from east to west by sixty-two miles from north to south, and embraces about 3350 square miles of territory. It is about 1000 miles from St. Paul and Duluth on the east and about

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[1] For much of the data in this account the author is indebted to President W. G. Pearce, of the Yellowstone National Park Association. The reader is also referred to Hayne's "Guide Book of the Yellowstone National Park" and to a charming brochure entitled "Sketches of Wonderland," issued by the Northern Pacific Railroad.

the same distance from Portland on the west, and about 1500 miles distant from each of the two cities of Chicago and San Francisco. We cannot here enter into a description of the scenic wonders of this grand and romantic region. Volumes might be devoted to a description of its woodland and meadow, its mountain torrents and placid lakes; its steaming, hissing geysers and appalling canyons, and its varied wealth of botanical and zoölogical curiosities, and still leave the half untold. The average elevation of the park is between 7000 and 8000 feet above the sea-level. Some of the mountain peaks attain an altitude of over 11,000 feet. Following is a table of altitudes of important points:

	Feet.		Feet.
Spinx	10,880	Lower Geyser Basin	7,252
Emigrant Peak	10,629	Middle Geyser Basin	7,300
Electric Peak	11,155	Upper Geyser Basin	7,400
Mt. Everts	7,600	Yellowstone Lake	7,738
Bunsen Peak	8,775	Grand Canyon Falls	7,710
Mammoth Hot Springs	6,387	Mt. Washburn	10,346
Quadrant Mountain	10,127	Dunraven Peak	8,867
Norris Geyser Basin	7,530	Grand Teton (Idaho)	13,691
Gibbon River Canyon	7,350		

The following time-schedule will give a comprehensive idea of the Park itinerary as observed by the official stages. This schedule is subject to variation at the discretion of the company, but is generally adhered to:

First day: Leave Livingston at 8.45 A.M.; arrive Cinnabar 10.45 A.M.; leave Cinnabar at 11.00 A.M.; arrive Mammoth Hot Springs Hotel 1.00 P.M., taking lunch, dinner, and lodging.

Second day: Breakfast. Leave Mammoth Hot Springs at 8.00 A.M., arriving at Norris at noon for lunch; leaving at 1.30 P.M., and arriving at Fountain Hotel, Lower Geyser Basin, at 5.30 P.M., for dinner and lodging.

Third day: Breakfast at Fountain. Leave for Midway and Upper Geyser Basin at 8.00 A.M. Lunch at Upper Geyser Basin. Dinner and lodging at Fountain Hotel.

Fourth day: Breakfast at Fountain. Leave for West Arm of Yellowstone Lake at 7.00 A.M. Lunch at lake, and leave the lake after lunch for Yellowstone Lake Hotel at lake outlet. Dinner and lodging.

Fifth day: Breakfast at Yellowstone Lake. Leave for Grand Canyon at 9.30 A.M.; arrive Grand Canyon at 12.30 P.M. Lunch, dinner, and lodging.

Sixth day: Breakfast. Leave Grand Canyon at 10.00 A.M.; arrive Norris at 12.30 P.M.; lunch; leave Norris at 1.30 P.M.; arrive Mammoth Hot Springs at 4.30 P.M. Dinner. Leave Mammoth Hot Springs at 6.30 P.M., arriving at Cinnabar at 8.00 P.M.; leave Cinnabar at 8.15 P.M.; arrive Livingston at 10.15 P.M.

The annexed table gives the correct distances between the most important points. The intersection between vertical and longitudinal columns will show the number of miles.

To From	Cinnabar.	Mammoth Hot Springs.	Golden Gate.	Obsidian Cliff.	Norris Geyser Basin.	Gibbon Meadows.	Gibbon Falls.	Lower Geyser Basin.	Excelsior (Midway) Geyser.	Upper Geyser Basin.	Keppler's Cascades.	West Arm Yellowstone Lake.	Yellowstone Lake Hotel.	Hayden Valley.	Grand Canyon.
Cinnabar	...	7	11	19	29	32	36	49	52	59	61	77	95	105	$\overset{41}{113}$
Mammoth Hot Spring	7	...	4	12	22	25	29	42	45	52	54	70	88	98	$\overset{34}{106}$
Golden Gate	11	4	...	8	18	21	25	38	41	48	50	66	84	94	102
Obsidian Cliff	19	12	8	...	10	13	17	30	33	40	42	58	76	86	90
Norris Geyser Basin	29	22	18	10	...	3	7	20	23	30	32	48	66	76	$\overset{12}{84}$
Gibbon Meadows	32	25	21	13	3	...	4	17	20	27	29	45	63	73	81
Gibbon Falls	36	29	25	17	7	4	...	13	16	23	25	41	59	69	77
Lower Geyser Basin	49	42	38	30	20	17	13	...	3	10	12	28	46	56	64
Excelsior (Midway) Geyser	52	45	41	33	23	20	16	3	...	7	9	25	43	53	61
Upper Geyser Basin	59	52	48	40	30	27	23	10	7	...	2	18	36	46	54
Keppler's Cascades	61	54	50	42	32	29	25	12	9	2	...	16	34	44	52
West Arm Yellowstone Lake	77	70	66	58	48	45	41	28	25	18	16	...	18	28	36
Yellowstone Lake Hotel	95	88	84	76	66	63	59	46	43	36	34	18	...	10	18
Hayden Valley	105	98	94	86	76	73	69	56	53	46	44	28	10	...	8
Grand Canyon	$\overset{41}{113}$	$\overset{34}{106}$	102	90	$\overset{12}{84}$	81	77	64	61	54	52	36	18	8	...

The small figures, in a few places, are the distances between the Grand Canyon and the various points noted *via* the return road in the tour from the Canyon to Norris. Adding together both large and small figures as they are found will give the total distance between such places as per the regular tour.

The Park Association conducts the hotels in the park under franchises issued by the United States Government. The following accommodations are offered to tourists with the assurance, as a general rule, of excellent service:

Mammoth Hot Springs: A large hotel, with steam-heat and electric light, located within easy walking distance of the Hot Springs. Accommodations for 150 tourists.

Norris Geyser Basin: A lunch station for the accommodation of tourists, located within a few minutes' walk of the geysers and pools, and two miles from Virginia Cascade, on the road to the Grand Canyon of the Yellowstone.

Lower Geyser Basin: The hotel at this point is located near the Fountain Geyser and Mammoth Paint Pots; has steam-heat, electric lights, and hot mineral baths. Accommodations for 250 tourists.

Upper Geyser Basin: A lunch station located near Old Faithful Geyser.

West Arm of Yellowstone Lake: A lunch station under canvas.

Outlet of Yellowstone Lake: A steam-heated and electric-lighted hotel of seventy-five rooms; with hot and cold bath facilities, and located on the shore of the lake, one mile from the mouth of the river, where the trout for which the Yellowstone Lake is noted can be readily brought to the surface with the hook and line. The Natural Bridge is about two miles west of the hotel. Accommodations for 125 tourists.

Grand Canyon and Falls of the Yellowstone: A hotel located within easy distance of the Great Falls and the numerous points of interest along the brink of the canyon. Steam heat, electric lights, hot and cold baths. Accommodations for 250 tourists.

The following data relating to the springs and geysers of the park will be found of interest. They are based upon careful observations made in 1894:

NORRIS BASIN.

Name.	Eruption in feet.	Duration of eruption.	Intervals of eruption.
Black Growler . . .	10 to 12	Continuous.	
Hurricane	Similar to Growler.		
Mud Geyser	10	20 to 30 min.	5 minutes.
New Crater	....	20 minutes.	2 hours.
Monarch	100	....	Varies about 12 hours.
Minute Man . . .	30 to 40	....	1 minute.
Emerald Pool . . .	Beautiful Spring.	....	40 to 50 feet wide.

LOWER BASIN.

Fountain	20 to 30	10 to 15 min.	2 to 4 hours.
Clepsydra Spring . .	Small but very pleasing.		
Mammoth Paint Pots .	Basin of clay, strangely colored, 40x60 feet wide.		
Great Fountain . . .	60 to 80	1 hour.	Frequent.

MIDWAY BASIN.

Excelsior	200 to 250	28 minutes.	Long intervals—years.
Turquoise Spring . .	Turquoise blue 100 feet diameter.		
Prismatic Lake . . .	Wonderfully colored water, 250x350 feet diam.		

UPPER BASIN.

Old Faithful . . .	150	6 minutes.	65 minutes.
Bee Hive	200	8 “	5 times a week.
Giantess	125	10 to 20 hours.	14 days.
Lion	75	10 minutes.	10 to 20 hours.
Lioness	100	12 “	24 to 48 hours.
Cubs	10 to 30	20 “	Frequent.
Surprise	60	30 “	Irregular
Sawmill	25	30 “	Very frequent.
Grand	200	30 “	15 to 20 hours.
Turban	30	30 “	Several times a week.
Riverside	90	15 “	8 hours.
Fan	30	10 “	8 hours.
Artemisia	100	10 “	Twice a day.
Jewell	40	2 “	Irregular.
Grotto	25	25 “	4 hours.
Giant	250	90 “	5 days.
Oblong	20	4 “	6 hours.
Splendid	200	8 “	At intervals every third day.
Castle	100	50 “	24 to 30 hours.
Economic	30	....	Frequent.
Sponge	Sponge-like geyser.		
Punch Bowel . . .	Beautiful spring, sometimes an active geyser.		
Black Sand Basin . } Specimen Lake . . }	Two very interesting objects. Some very fine coloring here.		
Morning Glory Spring .	Lovely spring with delicately colored rim.		
Biscuit Basin . . .	Peculiar spot with geyserite biscuits.		

Persons visiting the park should bear in mind that the killing of game or destruction, defacing, or removal of any object, however small, is expressly forbidden by law, any violation of which is punishable by a fine or imprisonment, or both. The park is under the control of the United States Government, and a sufficient number of troops are kept there the year round to patrol its limits and afford a watchful supervision to prevent acts of vandalism, and to enforce the regulations governing its use.

This great park is undoubtedly destined to become prominent as a health resort. Within its limits are contained upward of 2000 springs, many of which have been found to be highly mineralized as well as thermal. We present the following table of reactions, etc., of thirty-four of these springs, geysers and streams, which we have compiled from analyses made in 1883, 1884, and 1885 by Messrs. Frank Austin Gooch and James Edward Whitfield:[1]

SPRINGS AND GEYSERS OF THE YELLOWSTONE NATIONAL PARK.

	Temperature, F.[2]	Reaction.	Solid contents per U. S. gallon.[3] Grains.
Cleopatra Spring	159.80°	Alkaline.	121.64
Orange Spring	145.40	“	101.54
Hot River	136.40	“	113.10
Soda Bath Spring	64.40	“	. . .
Fearless Geyser	191.40	Neutral.	95.02
Pearl Geyser	187.20	“	. . .
Constant Geyser	197.60	Acid.	94.44
Coral Spring	163.40	“	111.35
Echinus Spring	195.80	Acid.	48.38
Schlammkessel	195.80	“	98.52
Fountain Geyser	179.60	Alkaline.	81.03
Great Fount'n Gey'r	179.60 to 199.80	“	76.37
Hygeia Spring	109.40	“	68.79
Madison Spring	140.00	“	76.95
Excelsior Spring	197.60	“	85.70
Old Faithful Geyser	187.20 to 191.40	“	81.03
Splendid Geyser	199.80	“	95.02
Giantess Geyser	199.80	“	82.20
Bee-hive Geyser	199.80	“	70.54
Grotto Geyser	199.80	“	82.78
Turban and Grand Geysers	195.80	“	81.03
Artemisia Geyser	192.02	“	86.28
Taurus Geyser	197.60	“	74.62
Asta Spring	187.20	“	39.05
Bench Spring	191.40	Slightly acid.	27.40
Chrome Spring	197.60	Neutral.	166.32
Alum Creek	. . .	Acid.	71.12
Mush-pot Spring	185.00	“	64.13
Devil's Ink-pot	197.60	“	197.05
Firehole River at Marshall's	44.40	Alkaline.	24.26
Gardiner Riv. ab. Hot Riv.	44.40	. . .	12.24
Water supply at Mammoth Hot Springs	. . .	. . .	15.74
Soda Springs	42.80	Acid.	48.90
Yellowstone Lake	. . .	. . .	99.11

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[1] Bulletin 47 of the United States Geological Survey, 1888.

[2] Converted from degrees Centigrade.

[3] Converted from grammes per kilogramme.

Most of these waters, it will be seen, are not only highly thermal, but are quite heavily mineralized, the solid contents ranging from 12.24 to 197.05 grains per gallon. These mineral ingredients consist chiefly of calcium, sodium, potassium lithium, magnesium, silicon dioxide, sulphur trioxide, carbon dioxide, chlorine, and basic oxygen. The chemists also discovered the following ingredients in small quantities or traces: Titanium, arsenic, iron, bromine, aluminium, manganese, barium, strontium, rubidium, caesium, ammonium, hydrogen sulphide, boron, phosphorous, and hydrochloric acid. The various combinations of these elements and bases have not been fully determined, but the waters may in general terms be classed as calcic, alkaline, silicious, saline, and sulphureted. It may be stated that the waters for the above examinations were collected during the months of July, August, September, and October, and the thermometric records represent as a rule the summer temperatures. It is probable that the waters of the hot-springs show little variation in temperature at the fountains during the year. We present in full the analysis of the Fountain Geyser, which may be regarded as fairly representative of the group. The hypothetical combinations have been worked out for the author by E. E. Smith, Ph.D., of New York:[1]

FOUNTAIN GEYSER (YELLOWSTONE NATIONAL PARK).

Alkaline. Muriated-saline.

One U. S. gallon contains:

Solids.	Grains.
Sodium chloride	30.47
Potassium chloride	2.09
Sodium bromide	0.03
Lithium bicarbonate	1.98
Sodium bicarbonate	22.46
Magnesium bicarbonate	0.35
Calcium bicarbonate	0.33
Iron bicarbonate	0.035
Manganese bicarbonate	Trace.
Potassium sulphate	2.48
Sodium phosphate	0.01
Sodium tetraborate	1.16
Sodium arseniate	0.20
Alumina	0.96
Silica	19.33
Total	81.885

The water also contains free carbonic acid and a trace of sulphureted hydrogen.

This analysis presents a fairly strong alkaline-saline water. It possesses useful properties as an antacid, diuretic, and aperient. In addition it contains an appreciable quantity of arsenic, and in continued dosage should speedily produce the physiological effects of that drug. The water of La Bourbole, in France, which contains but slightly more arsenic than this geyser, has long been celebrated in the treatment of skin diseases, notably in eczema and the other rheumides. The Yellowstone waters will no doubt in time be found to possess equal virtues in these affections. At the present time the waters are used for bathing only at the Fountain Geyser Hotel. At this resort the waters are conducted into the hotel building, which is supplied with an excellent system of bath-rooms. The thermal waters of the park will probably come into high repute in the near future in the treatment of gout, rheumatism, and syphilitic affections. Some of the springs contain a considerable proportion of sulphureted hydrogen, while free hydrochloric acid is found in several others. We may expect that all of these different waters will at some future time render useful service in practical therapeutics. We are informed that intensely hot weather is practically unknown in the park. Following is a temperature table of the summer and early fall months, made during a recent season:

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[1] The combinations, as estimated by the original analysts, have recently come under our observation. The result does not materially differ from those given above. It is probable that the proportion of sodium arseniate is somewhat overestimated.

	Sunrise.	Mid-day.	Sunset.	Mean.
July	55° F.	77° F.	69° F.	67° F.
August	50	79	66	65
September . . .	41	66	58	55
October . . .	41	57	52	50

Visitors to the park should be amply prepared for cool weather, no matter what the season may be.

APPENDIX.

POTABLE WATERS.

The ultimate source of all drinking-water is the rainfall. This passes to various parts of the earth's crust, forming collections that have been conveniently designated *surface*, *subsoil* or *ground*, and *underground* or *deep* water. Available deep waters are termed *phreatic*.

Natural water is never chemically pure, but contains foreign substances whose character and quantity determine its sanitary purity and fitness for general domestic use. Even the water that rises in small vesicles from the earth to form clouds contains a trace of solid matter, and as it descends in the form of rain, it gathers additional substances from the atmosphere (*vide* page 21). Rain-water is collected for use by catchment areas, usually roofs, and is conducted through waterways to reservoirs, which are commonly underground cisterns. The surface of the earth is a large catchment area by which 50 per cent. or less of the rainfall is directly conducted into lakes and streams. Here it mingles with water of subsoil and deep origin, which has reached the surface through springs. The portion of rain and melted snow that does not pass into the surface collections enters the somewhat indefinite body of subsoil or ground-water, gathering into solution various substances from the soil. Ground-water is found in shallow wells, either dug or driven, and in small hillside springs. Beneath the geological strata that support this hidden, subsoil water-table are collections of deep water. It is the portion of the rainfall that has found its way beneath impervious strata, either through fissures or at distant points where the strata reach the surface, and differs from the subsoil-water in temperature, in the small amount of oxygen it contains, and in the general character of its ingredients, frequently being highly mineralized. As has been previously stated, most mineral waters belong to this class. Phreatic waters reach the surface through springs, artesian wells, and dug wells.

Of the foreign substances that are present in natural waters, some enhance and others impair its potable quality. Among the former are the gases introduced in aëration, and many mineral ingredients, while among the latter are poisonous mineral substances, a great excess of saline and earthy matter, many products of industrial waste, usually an excess of organic matter, certain microscopic organisms which render water unpalatable, and, finally, and by far the most objectionable, harmful parasitic and bacterial organisms, some of which constitute the veritable essence of infection. It is the presence of these forms of life in animal and human refuse that renders its introduction into drinking-water particularly objectionable.

The quality of water is not alone dependent on the foreign substances which it has taken up, but is determined as well by the chemical and biological changes which such substances undergo. Thus, natural purification from sewage pollution may occur; again, on the other hand, water may deteriorate from decomposition of organic matter, a change induced by the growth of bacterial and microscopic organisms present.

Natural waters are commonly classed, in respect to their potability, as (1) *normal* and (2) *polluted*, the latter including all waters contaminated with sewage and products of industrial waste. It does not follow, however, that all normal waters are sanitarily pure; as, for example, certain swamp-waters containing much vegetable organic matter, which tends to undergo decay, the use of which may be followed by epidemics of diarrhœa of mild or severe form. Again, it is now recognized that the water of stagnant ponds in malarial regions is commonly the carrier of the malarial parasites which, moreover, are not introduced through sewage pollution, but probably by insects, particularly mosquitoes, which suck the blood of malarial subjects and carry the organisms to the surface of the water, where these insects are wont to congregate and where they die in large numbers. Still other unwholesome normal waters are hard waters, producing intestinal derangement, and those containing poisonous metals.

On the other hand, the waters which are *en vérité* the source of disease, and to which the sanitarian's attention is particularly directed, are polluted waters, especially those polluted with sewage, for they may become the carriers of infection, producing rapid and fatal epidemics. The two well-recognized, water-borne, infectious diseases are cholera and typhoid fever. There are frequent and familiar instances where their propagation is known to have been entirely due to the use of polluted waters.

The most common source of the pollution of rain-water is the exposure incident to its collection and storage, particularly the exposure to sewage-drains and cesspools adjacent to leaky cisterns. That such contamination does occur may in some instances be demonstrated by the introduction into the cesspool of some coloring matter or peculiar chemical and its subsequent recognition in the stored rain-water. The exposure of surface-water to pollution is dependent on the nature of the water-shed, and in general is proportional to the population of the territory. Ground-water is exposed to contamination from the surface of the water-shed and, in addition, from the hidden refuse of sewage, cesspools, and privy vaults, sources that often escape detection when the locality is superficially inspected. Even deep waters are occasionally polluted from local sources when the rock strata are nearly vertical in position.

How to readily dispose of sewage and at the same time protect from pollution nature's water-supply, is a problem which in large centres of population is difficult of solution. The ideal arrangement, as recently stated by one author, is that a land should be looked upon as watered by its smaller lakes, its springs, and its brooks, and sewered by its great, especially its navigable, rivers. No river or stream should be added to the list of sewage drains except by legislative permission. Unfortunately, this ideal condition is not found at the present time in many localities.

It appears, then, that potable water is found in each of the natural classes, and, further, that water belonging to each class may be polluted: rain-water in its collection and storage; surface-water from the water-shed and the admixture of subsoil-water; ground-water from various sources, not always readily detected, and, occasionally, deep-waters from both local and remote sources. Omitting for the moment the consideration of the various technical data which combine to demonstrate the purity or impurity of water, let us briefly consider the methods that may be adopted to render polluted water suitable for drinking.

Not many years ago it was believed that the purification of polluted water is readily accomplished by nature, which needs no artificial aid; that a stream flowing a few miles purifies itself. It was little thought that the inhabitants on the banks of a stream were receiving disease through the water from their neighbors above, and in turn conveying disease to those below, by themselves polluting the stream. It is now recognized that water may flow many miles without accomplishing purification. Nature's methods, *aëration*, *sedimentation*, *soil-filtration*, and *sunlight*, may have little opportunity to effect this result where the land is thickly populated, and it is frequently desirable to supplement her efforts by artificial purification.

This is readily accomplished, on a domestic scale, by boiling or distillation, which renders the water safe both by removing foreign substances and by destroying the disease germs. A measure which usually yields a more palatable product is filtration; but, unfortunately, few of the filters offered in the markets can justly claim to accomplish the results most desired, namely, the removal of the disease germs. This is true of all the charcoal filters that are attached to the water-tap; these, in fact, often infect rather than purify the water, though yielding a product acceptable in appearance. On the other hand, filtration of water through properly kept unglazed porcelain candles does remove the bacteria, and filters constructed on this principle may at the present time be bought in the large cities. The filtration is slow and the filters need intelligent care to insure efficiency.

The purification of large bodies of water for public supplies must in some instances be undertaken, and the present success in this direction demonstrates that it is feasible. An efficient and practical method is filtration through sand-beds. This was undertaken in 1893 at Lawrence, Mass., where the water-supply is taken from the Merrimac River, nine miles below the city of Lowell. The high death-rate at Lawrence from typhoid fever led the municipal authorities to undertake the artificial purification of this water-supply. A filtering bed was constructed, covering an area of two and a half acres, and consisting of suitable sand, for a depth of about five feet, properly underdrained into a conduit for the filtered water. The filtering capacity of this ingenious device is, under one foot head, about five million gallons in the twenty-four hours. The water is improved (1) by the removal of the suspended matter, (2) by the combustion of the organic matter that is readily oxidizable, and (3) by the removal of 99 per cent., practically all, of the bacteria. The typhoid mortality has been reduced by the use of this filter to a figure comparing favorably with that of other cities where pure water is supplied to the inhabitants.

Evidence of impurity is afforded by chemical analysis, microscopical examination, bacteriological examination, and the history and surroundings of the supply.

Chemical analysis is directed to the detection of organic matter, its quality and quantity, of poisonous metals and other objectionable mineral substances, and of special impurities, as the products of industrial waste. The usual data obtained by chemical analysis are :

Oxygen consumed, which is an index to the amount of organic matter.

Nitrogen, present as "albuminoid" ammonia, free and saline ammonia, nitrites and nitrates, which furnishes evidence of the quantity of nitrogenous organic matter, its quality and condition, and whether it is undergoing change.

Chlorides, which always accompany organic matter of animal origin, and which are, therefore, increased in amount by pollution.

Total solids, which in good waters do not exceed a certain limit, which experience has established for each class of natural waters. The appearance of the solids on ignition furnishes evidence of the character of the organic matter present.

Inorganic salts, including poisonous metals and earthy salts, which may prove injurious to the processes of digestion and general nutrition and render the water too hard for general domestic use.

The chemical evidence most suggestive of pollution is that furnished by the nitrogen present. This exists to a considerable extent in vegetable and animal organic matter in a highly organized combination, and when present in water in this form furnishes the "albuminoid" ammonia of analysts. In addition, animal waste, and, consequently, sewage, contains much nitrogen in the forms of free and saline ammonia. When oxidized, ammonia nitrogen enters into the formation of nitrites, and ultimately nitrates. It is evident, then, that much "albuminoid" ammonia indicates the presence of considerable organic matter, while if much free ammonia is present as well, and especially if the amount of chlorine is above the local normal, we have presumptive evidence of the existence of sewage pollution. In such a water, moreover, in which the bacteria of animal waste are present, oxidation is rapidly proceeding, and an appreciable quantity of the transient nitrite is present. Finally, nitrogen in the form of nitrates is the ultimate product into which the nitrogen is oxidized, and when present without an increase in the other forms, and especially in the absence of bacteriological evidence of pollution, indicates remote rather than recent contamination.

There are, however, other factors to be considered, without a knowledge of which these findings may be misleading. For example, chlorides may be increased by proximity to the sea. Again, chlorides and nitrates may be obtained from the strata of earth through which the water passes, in which case they furnish no evidence of pollution at all. Further, nitrates thus obtained may be reduced to nitrites, as by reducing organisms of the soil or by the action of the zinc-iron couple furnished by galvanized iron collecting-pipes and storage vessels. It is evident, therefore, that in forming a judgment of the sanitary purity of a water the general nature, history, and surroundings of the supply furnish data quite as important to consider as the amount and quality of the substances held in solution, and that without this knowledge the analytical results may be misinterpreted. It is very probable that good water is frequently condemned on insufficient data.

The following table shows the usual range of the analytical data of pure waters:

USUAL FINDINGS IN UNCONTAMINATED WATERS.

One U. S. gallon contains	Rain.	Surface.	Subsoil.	Deep.
	Grs.	Grs.	Grs.	Grs.
Nitrogen of free and saline ammonia	0.01 to 0.03	None to 0.002	None to 0.002	Moderate or large amount
Nitrogen of albuminoid ammonia	0.004 to 0.01	0.003 to 0.01	0.003 to 0.007	0.002 to 0.007
Nitrogen of nitrites . .	None or trace	None	None	None or trace
Nitrogen of nitrates . .	None or trace	None to 0.1	0.1 to 0.3	None to 0.15
Chlorine	Trace to 0.05	0.05 to 0.5	0.05 to 0.6	0.05 to large amount
Total solids	0.02 to 1.0	1.0 up	2.0 up	3.0 up

RESULTS OF THE CHEMICAL ANALYSIS OF WATER SUPPLIES.

Supply.	Date.	Oxygen consumed.	Nitrogen of free and saline ammonia.	Nitrogen of albuminoid ammonia.	Nitrogen of nitrites.	Nitrogen of nitrates.	Chlorine.	Total solids.
One U. S. gallon contains:	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.
New York City Croton Water . .	July 2, 1897	……	0.0006	0.0096	None	0.0140	0.155	4.66
Boston, Mass., city supply . . .	Aver'ge 1895	0.495	0.0008	0.0116	0.00006	0.0055	0.22	2.70
Brooklyn, N. Y., Ridgewood Reservoir	June 23, 1897	……	0.00006	0.0062	None	0.1104	0.904	4.78
Hartford, Ct., Reservoir No. 4 . .	June, 1897	……	0.0073	0.0244	Trace	Trace	0.0986	
Hartford, Ct., Reservoir No. 5 . .	June, 1897	……	0.0022	0.0046	None	None	0.0174	
Burlington, Vt., Lake Champlain .	……	0.088	0.0017	0.0067	None	Trace	0.0406	4.06
Poughkeepsie, N. Y., Hudson River .	……	0.133	0.0024	0.0060	Trace	Trace	0.261	4.93
Albany, N. Y., Hudson River . .	……	0.3306	0.0034	0.0096	Trace	0.0047	0.145	
Cohoes, N. Y., Mohawk River . .	……	0.2059	0.0029	0.0102	0.00012	0.0143	0.232	
Philadelphia, Pa , Schuylkill River .	……	……	0.0005	0.0048	None	0.0267	……	7.73
Cincinatti, O., Ohio River . . .	……	……	0.00014	0.0052	…….	0.015	0.812	8.12
Washington, D. C., Potomac River .	……	0.059	0.0024	0.0061	Trace	0.0133	0.0638	9.57
Richmond. Va., James River . .	……	0.0959	0.0264	0.0072	Trace	Trace	0.0679	6.09
Rock Island, Ill., Mississippi River .	……	0.348	0.0012	0.0125	None	Trace	0.058	8.12
New Orleans, La., Mississippi River .	……	0.332	0.0019	0.0156	None	0.0046	0.841	19.72
Springfield, Mass.	1893	0.298	0.00043	0.0097	0.00006	0.0015	0.087	2.18

Microscopical examination reveals foreign substances suspended in water and microscopic organisms[1] present. The foreign substances may suggest the source of contamination of impure waters, and the forms of life present may explain peculiarities of appearance or of odor and taste. This form of examination is more frequently of service in the analysis of surface waters. In a recent report of the New York State Board of Health we read: "Many of the micro-organisms produce, either by their processes of growth or by their decay, substances which are detrimental to the water, more especially so far as taste and odor are concerned, though some of them affect its use for cleaning purposes, and others, in too great abundance, seem to affect the health of drinkers of the water."

The Massachusetts State Board of Health has made extensive use of the microscopical examination of drinking-waters, and the following are illustrative of the opinions which have been influenced thereby: Advice to the towns of Hingham and Hull (Accord Pond).

"Investigations made this year show that the taste and odor were due principally to the presence of a minute vegetable organism called *anabæna*, which was found in great abundance either distributed through the water of the pond or floating upon the surface as a green scum. This organism is seldom present in unpolluted natural ponds which have not been raised, but is frequently found in artificial reservoirs which have been filled with water without removing the soil and vegetable matter from the bottom and sides."

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[1] The term "microscopic organisms" is here used to designate the forms of life, both animal and vegetable, which are readily observed under the microscope, and does not include bacterial organisms.

This water, examined in June, showed in each cubic centimetre: *Diatomaceæ*, 22; *cyanophyceæ*, 17; *anabæna*, 8; *algæ*, 45. Odor, decidedly vegetable, mouldy, and disagreeable.

Water from Floating Bridge Pond, at Lynn, possessed a distinctly disagreeable odor, becoming vegetable and grassy on heating. Examined in July, 1894, it showed in each cubic centimetre:

Diatomaceæ:		Infusoria:	
Melasira	62	Dinobryon cases	3
Synedia	1	Peridinium	1
Tabellaria	216	Trachelomonas	1
Cyanophyceæ:		Vermes:	
Anabæna	760	Anurea	2
Oscillaria	5	Monocerca	1
Algæ:		Rotifer	1
Arthrodesmus	6	Miscellaneous:	
Closterium	160	Zoogloea	48
Staurastrum	64		
		Total	1332

Regarding this water the report states: "Not of suitable quality for domestic use. The principal objection to the water at the present time is that it contains a very large number of microscopic organisms, which give the water a greenish turbidity and a disagreeable odor, and make it unpalatable."

The bacteriological examination of water is directed either to the detection of specific pathogenic organisms or to the identification of the bacteria characteristic of sewage, whose presence is significant of sewage pollution. It is not required in practice to identify all the bacteria present, since a knowledge of the many organisms obtained by contact with the air and soil is without value in determining its sanitary purity. A mere knowledge of the number of bacteria present, which heretofore has received so much attention, is likewise, in most instances, of limited value. The detection of specific pathogenic bacteria, on the other hand, cannot be undertaken with advantage as a routine procedure; for although the identification of a pathogenic organism establishes with certainty the infectious nature of the supply, yet the failure to find such a bacterium still leaves the purity of the water an open question. Bacterial examination is directed with greatest advantage to the detection of the organisms characteristic of sewage, for in reality the question of sewage pollution and contamination with pathogenic bacteria are one. This procedure is comparatively simple, and with proper precaution leads to results that are conclusive.

Human and animal excrement contains the *bacillus coli communis*, which is, therefore, constantly present in sewage, as are also bacteria capable of producing putrefaction. Taking advantage of these facts and also of the fact that excrement, and hence sewage, contains numerous *anaërobic* or *facultative anaërobic bacteria*, Dunham has suggested the establishment of the following data as a preliminary procedure in the examination of water for evidence of sewage pollution:

1. Number of bacterial organisms in a cubic centimetre.
    a. Growth on nutrient gelatin in air.
    b. Growth on nutrient gelatin in hydrogen.
2. Test for bacteria of putrefaction.
3. Tests for bacteria of fermentation.

The presence of but few organisms capable of growing in an atmosphere of hydrogen, in addition to negative putrefactive and fermentation tests, indicates the absence of recent sewage pollution. Positive results, on the other hand, suggest such pollution, and call for isolation of the suspicious organisms and their identification by means of their morphological and biological characters. With a knowledge of the suspicious bacterial forms, the existence or absence of pollution is determined.

The following are illustrative examples of the results of such examinations (the figures express the number of bacterial organisms per cubic centimetre):

1. PURE WATERS.

	1	2	3	4
Source	Driven Well.	Dug Well.	Spring, deep.	Spring, deep.
Growth in air	8	459	270	264
Growth in hydrogen . .	0	62	7	0
Putrefactive test . . .	Negative.	Negative.	Negative.	Negative.
Fermentation tests . .	"	"	"	"

Specimen 2. The considerable number of anærobics observed were facultative anærobics from the soil.

2. WATERS OF DOUBTFUL PURITY.

	5	6	7	8
Source	Croton Water. (Dunham.)	Old well.	Well.	Sewage. (Dunham.)
Growth in air . . .	135	11,088	....	51,516
Growth in hydrogen . .	30	3,520	....	49,871
Putrefactive test . . .	Positive.	Positive.	Positive.	Positive.
Fermentation tests . .	"	"	"	"

Specimen 5. Organism identified, bacillus coli communis, proteus vulgaris.
Specimen 6. Bacteria suggestive of sewage contamination.
Specimen 7. Bacillus coli communis, bacillus lactis aërogenes.

To these various technical data should be added a knowledge of the history and surroundings of the water-supply. While the detection of pollution by chemical analysis and bacteriological and microscopical examination is the province of the chemist and the microscopist, any person capable of acute observation and logical deduction can learn much, frequently all that is necessary, of the nature of the supply by careful inspection of its surroundings; yet notwithstanding this, serious dangers constantly escape recognition. Of the local domestic supplies, the leaky cistern is sometimes at fault, but far more frequently it is the well, whose cool, sparkling water, refreshing and inviting, is in truth a receptacle of refuse revolting to the mind as it is destructive to the body. In the presence of these facts, it is well to remember that nature supplies a vast store of pure water, and that its selection for domestic use is, in most instances, as convenient as it is desirable.

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